U.S. Department of the Interior
U.S. Geological Survey

Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, Through December 1999

Open-File Report 00-479

Prepared in cooperation with the
NEVADA OPERATIONS OFFICE of the
U.S. DEPARTMENT OF ENERGY, under
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Carson City, Nevada
2001

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CONTENTS

FIGURES

TABLES

CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
acre-foot (acre-ft)	1,233	cubic meter
foot (ft)	0.3048	meter
gallon per minute (gal/min)	0.06309	liter per second
inch (in.)	2.54	centimeter
mile (mi)	1.609	kilometer
million gallons (Mgal)	3,785	cubic meter
pound per square inch (lb/in^2)	6.895	kilopascal

Sea level: In this report, “sea level” refers to the National Geodetic Vertical Datum of 1929 (NGVD of 1929, formerly called “Sea-Level Datum of 1929”), which is derived from a general adjustment of the first-order leveling networks of the United States and Canada.

Selected Ground-Water Data for Yucca Mountain Region, Southern Nevada and Eastern California, through December 1999

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ABSTRACT

The U.S. Geological Survey, in support of the U.S. Department of Energy, Yucca Mountain Site Characterization Project, collects, compiles, and summarizes hydrologic data in the Yucca Mountain region. The data are collected to allow assessments of ground-water resources during studies to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste.

Data on ground-water levels at 34 wells and a fissure (Devils Hole), ground-water discharge at 5 springs and a flowing well, and total reported ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and the Amargosa Desert are presented for calendar year 1999. Data collected prior to 1999 are graphically presented and data collected by other agencies (or as part of other Geological Survey programs) are included to further indicate variations of ground-water levels, discharges, and withdrawals through time.

A statistical summary of ground-water levels at seven wells in Jackass Flats is presented to indicate potential effects of ground-water withdrawals associated with U.S. Department of Energy activities near Yucca Mountain. The statistical summary includes the number of measurements, the maximum, minimum, and median water-level altitudes, and the average deviation of measured water-level altitudes for selected baseline periods and for calendar years 1992–99. At two water-supply wells median water levels for calendar year 1999 were unchanged from their respective baseline periods. At a nearby observation well, the 1999 median water level was slightly lower (0.1 foot) than its baseline period. At the remaining four wells in Jackass Flats, median water levels for 1999 were slightly higher (0.2 foot to 1.6 feet) than for their respective baseline periods.

INTRODUCTION

Investigations are in progress or planned to determine the potential suitability of Yucca Mountain for storing high-level nuclear waste. The U.S. Department of Energy (DOE) has declared that all facilities and activities associated with such investigations will be operated in a manner that maintains or protects environmental quality, and has established programs to allow assessments of environmental quality. In April 1989, the U.S. Geological Survey (USGS) began a cooperative program with DOE to develop a ground-water-resources monitoring program in the vicinity of Yucca Mountain. The purposes of the monitoring program are to (1) document the historical and current conditions of ground-water resources, (2) detect and document changes in those resources during the investigations of Yucca Mountain, and (3) provide a basis for analyzing and identifying potential adverse effects on ground-water resources resulting from investigations of Yucca Mountain.

Purpose and Scope

This report presents and summarizes, in tabular and graphical form, data collected as part of the U.S. Geological Survey Environmental-Monitoring Program. Included are 1999 data on ground-water levels at 34 wells and a fissure (Devils Hole), ground-water discharge at 5 springs and a flowing well, and total reported ground-water withdrawals within Crater Flat, Jackass Flats, Mercury Valley, and Amargosa Desert. Data on ground-water levels, discharges, and

withdrawals collected by other agencies (or collected as part of other USGS programs) at the sites are included also to further indicate variations through time at selected monitoring locations.

A discussion of ground-water data for Jackass Flats includes a statistical summary of that data to indicate potential effects of withdrawals from wells in Jackass Flats on water levels near Yucca Mountain. Effects of these withdrawals may be detected in Jackass Flats before they are detected elsewhere in the Yucca Mountain region.

This report is the eighth in a series of annual reports as part of the U.S. Geological Survey Environmental-Monitoring Program. Hereafter, the first seven reports are referred to as previous reports on selected ground-water data for the Yucca Mountain region. The previous reports and the data they contain are:

Report (see references cited)	Data contained
La Camera and Westenburg (1994)	Earliest available data through 1992
Hale and Westenburg (1995)	Data collected in 1993
Westenburg and La Camera (1996)	Data collected in 1994
La Camera, Westenburg, and Locke (1996)	Data collected in 1995
La Camera and Locke (1998)	Data collected in 1996
La Camera, Locke, and Munson (1999)	Data collected in 1997
Locke (2001)	Data collected in 1998

Additional information for sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12 is presented by Robison (1984), Robison and others (1988), Gemmel (1990), McKinley and others (1991), O'Brien (1991, 1993), Luckey and others (1993), Boucher (1994), Lobmeyer and others (1995), O'Brien and others (1995), Graves (2000), Graves and others (1996), Tucci, Goematt, and Burkhardt (1996), Tucci, O'Brien, and Burkhardt (1996), and Graves and Goemaat (1998).

Acknowledgments

Several organizations and programs contributed to this report. Specifically, data were provided by National Park Service; U.S. Fish and Wildlife Service; Nevada Department of Conservation and Natural Resources, Division of Water Resources; Nevada Department of Transportation; Barrick Bullfrog Inc.; Bechtel Nevada; Cathedral Gold U.S. Corporation; Cind-R-Lite Company; Daisy Gold Mining Company; U.S. Borax Corporation; U.S. Nevada Gold Search; USGS-Hydrologic Resources Management and Environmental Restoration Programs; and USGS–Yucca Mountain Project Branch studies of saturated-zone site hydrology and saturated-zone regional hydrology.

Additionally, the author acknowledges the cooperation of the many individual property owners throughout the Amargosa Desert who allowed access to their property for the collection of hydrologic data.

DESCRIPTION OF STUDY AREA

The study area is the Yucca Mountain region of southern Nevada and eastern California (fig. 1). The boundary of the Yucca Mountain region, for purposes of this report, roughly coincides with the northern parts of Crater Flat and Jackass Flats, eastern parts of Rock Valley, Mercury Valley, and Amargosa Desert, Nev., and Death Valley Junction and Furnace Creek, Calif., to the south and west. The region is within the Great Basin, a subdivision of the Basin and Range Physiographic Province (Fenneman, 1931, p. 328).

The study area is in the Death Valley ground-water flow system (Harrill and others, 1988, sheet 1) and, within that flow system, the Alkali Flat–Furnace Creek Ranch and Ash Meadows ground-water subbasins. Each ground-water subbasin is a zone consisting of ground-water recharge areas and flow paths to points of discharge at land surface (Waddell and others, 1984, p. 36; Laczniak and others, 1996, p. 16 and pl. 1). Boundaries of the subbasins are defined on the basis of the location of recharge areas, discharge areas, low-permeability rocks, hydraulic gradients, and water chemistry. These boundaries are general indicators of restrictions on ground-water movement in the region.

The study area is also subdivided by hydrographic areas[1] (fig. 1). As defined by Rush (1968, p. 4), hydrographic areas generally consist of valleys (topographic lows) extending to their surrounding surface-water drainage divides (topographic highs). Hydrographic areas in the study area include Crater

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[1]Formal hydrographic areas in Nevada were delineated systematically by the U.S. Geological Survey and Nevada Division of Water Resources in the late 1960's for scientific and administrative purposes (Rush, 1968; Cardinalli and others, 1968). The official hydrographic area names, numbers, and geographic boundaries continue to be used in Geological Survey scientific reports and Division of Water Resources administrative activities. Extensions of hydrographic areas from Nevada into California and selected hydrographic areas in California have been delineated also by Harrill and others (1988, sheet 2).

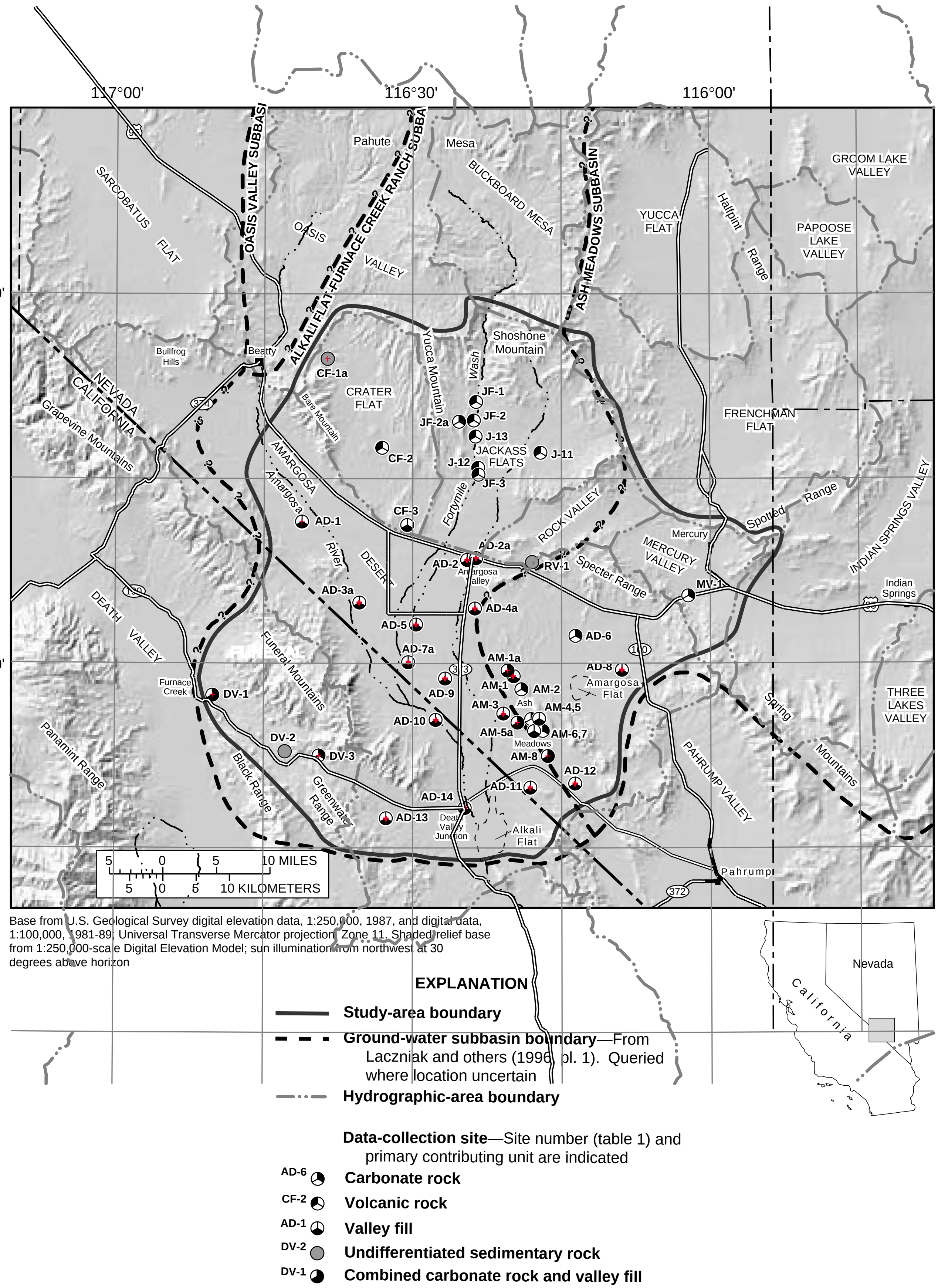

Figure 1. Location of data-collection sites for calendar year 1999, Yucca Mountain region of southern Nevada and eastern California.

Flat, Jackass Flats, and Rock Valley, most of Mercury Valley and Amargosa Desert, and part of Death Valley (Rush, 1968; Harrill and others, 1988, sheet 2).

Alkali Flat–Furnace Creek Ranch Ground-Water Subbasin

Crater Flat and Jackass Flats (which include Yucca Mountain), most of Rock Valley, the west-central part of the Amargosa Desert, and part of Death Valley are in the Alkali Flat–Furnace Creek Ranch ground-water subbasin (fig. 1). Within this subbasin, sources of ground water principally are precipitation and subsurface inflow (Laczniak and others, 1996, table 3; Waddell and others, 1984, p. 36; Harrill and others, 1988, sheet 2). Precipitation occurs on the higher mesas and mountains within the subbasin and along the subbasin's north and northeast mountainous boundaries. Inflow into the subbasin occurs near Beatty from the Oasis Valley subbasin, near Ash Meadows from the Ash Meadows subbasin, and from Cactus Flat (about 40 miles (mi) north of Beatty). Ground water discharges principally as springflow in Death Valley and as evapotranspiration from Alkali Flat and Death Valley. Ground water generally flows to the south, southeast, or southwest and discharges principally in Death Valley and at Alkali Flat (Kilroy, 1991, p. 9–13; Laczniak and others, 1996, pl. 1; Tucci and Burkhardt, 1995, p. 8).

Ash Meadows Ground-Water Subbasin

Part of Rock Valley, most of Mercury Valley, and the eastern part of the Amargosa Desert are within the Ash Meadows subbasin (fig. 1). The southeastern part of the Amargosa Desert includes the Ash Meadows spring-discharge area. The Ash Meadows spring-discharge area is a gently sloping land watered by numerous springs (Dudley and Larson, 1976, p. 5) at the southwestern edge of the subbasin.

In the Ash Meadows ground-water subbasin, sources of ground water principally are precipitation and subsurface inflow (Laczniak and others, 1996, table 3). Precipitation occurs on the higher mountains within the subbasin and along the subbasin's north and northeast mountainous boundaries. Inflow occurs from Railroad Valley and Pahranagat Valley along the basin's north and northeast boundaries (about 100 mi north of Ash Meadows). Ground water discharges principally as springflow and evapotranspiration in the Ash Meadows area and possibly as underflow into the Alkali Flat–Furnace Creek Ranch ground-water subbasin. Ground water in the subbasin generally flows to the south, west, or southwest (Harrill and others, 1988, sheet 2; Laczniak and others, 1996, p. 16–18 and pl. 1).

DATA-COLLECTION SITES

Locations of data-collection sites are shown in figure 1. Information on site identification, site location, site owner, and the types of data contained in this report are given in table 1 for each site. Data on well construction, sources of well-construction data, and contributing lithologic units are given in table 2. All sites are wells or springs except site AM-4 (Devils Hole), which is an open fissure that intersects the ground-water table.

Site Number

Sites in this report are identified by an alphanumeric number consisting of two parts. The first part represents the hydrographic area in which the site is located: "CF" represents Crater Flat; "JF" or "J," Jackass Flats; "RV," Rock Valley; "MV," Mercury Valley; "AD" or "AM," Amargosa Desert; and "DV," Death Valley. "AM" further indicates that the site is located in the Ash Meadows spring-discharge area. The second part of the number represents the relative location of the site within the hydrographic area (or Ash Meadows spring-discharge area). Within each hydrographic area, sites generally are numbered sequentially in a north-to-south, then west-to-east order. Sites added subsequent to the initial numbering also are numbered as indicated above or are assigned the number of a nearby site and given the suffix "a." Exceptions are sites J-13, J-11, and J-12, which are or were intended water-supply wells and were previously numbered by Raytheon Services Nevada; they were not renumbered for this report. The sequence of sites in table 1 is followed throughout the report.

Table 1. Index to monitoring sites in Yucca Mountain region for calendar year 1999

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See section “Site Number” for further discussion.

U.S. Geological Survey site identification: Unique identification number for sites as stored in files and data bases of U.S. Geological Survey.

Local site number: Alphanumeric number based on location of site within hydrographic areas and rectangular subdivisions of public lands. See section “Local Site Number” for further discussion.

Owner: Abbreviations listed for sites owned by federal agencies: BLM, Bureau of Land Management; NPS, National Park Service; DOE, U.S. Department of Energy; USFWS, U.S. Fish & Wildlife Service; USGS, U.S. Geological Survey.

Data type: Type of data included in this report: D, ground-water discharge; L, ground-water level.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Latitude	Longitude	Local site number		Owner	Data type
CF-1a	365445116383901	GEXA Well 3	36°54′42″	116°38′41″	229	S12 E48 07ADD1	Rayrock Mines, Inc.	L
CF-2	364732116330701	USW VH-1	36°47′32″	116°33′07″	229	S13 E48 27C1	DOE	L
CF-3	364105116302601	Cind-R-Lite Well	36°41′06″	116°30′26″	229	S14 E48 36DDD1	Cind-R-Lite Block Company	L
JF-1	365116116233801	UE-25 WT 15	36°51′16″	116°23′38″	227A	S12 E50 33A1	DOE	L
JF-2	364945116235001	UE-25 WT 13	36°49′43″	116°23′51″	227A	S13 E50 18B1	DOE	L
JF-2a	364938116252102	UE-25p 1 PTH	36°49′38″	116°25′21″	227A	S13 E49 14A2	DOE	L
J-13	364828116234001	J-13 WW	36°48′29″	116°23′40″	227A	S13 E50 19C1	DOE	L
J-11	364706116170601	J-11 WW	36°47′06″	116°17′06″	227A	S13 E51 31B1	DOE	L
J-12	364554116232401	J-12 WW	36°45′54″	116°23′24″	227A	S14 E50 06A2	DOE	L
JF-3	364528116232201	JF-3 Well	36°45′28″	116°23′22″	227A	S14 E50 06D1	DOE	L
RV-1	363815116175901	TW-5	36°38′15″	116°17′59″	226	S15 E50 24A1	DOE	L
MV-1	363530116021401	Army 1 WW	36°35′30″	116°02′14″	225	S16 E53 05ADB1	DOE	L
AD-1	364141116351401	NA-6 Well BGMW-10	36°41′31″	116°41′14″	230	S14 E47 32DA1	USGS	L
AD-2	363830116241401	Airport Well	36°38′25″	116°24′33″	230	S15 E49 24ABB1	Doing, Warren	L
AD-2a	363835116234001	NDOT Well	36°38′35″	116°23′58″	230	S15 E50 18CCDB1	Nev. Dept. of Transportation	L
AD-3a	363521116352501	Davidson Well	36°35′25″	116°35′30″	230	S16 E48 05CAB1	Davidson, Robert	L
AD-4a	363428116234701	Cooks East Well	36°34′30″	116°23′45″	230	S16 E50 07CABB1	Cook, Lewis C.	L
AD-5	363310116294001	USBLM Well	36°33′25″	116°29′45″	230	S16 E49 18DCCA1	BLM	L
AD-6	363213116133800	Tracer Well 3	36°32′13″	116°13′38″	230	S16 E51 27BAA3	USGS	L
AD-7a	363009116302702	Blackman Well	36°30′10″	116°30′30″	230	S17 E48 01AB3	Naxos Mining Company	L
AD-8	362929116085701	Cherry Patch Well	36°29′30″	116°08′55″	230	S17 E52 08CDB1	Clark, Hershel, and others	L
AD-9	362848116264201	Gilgans North Well	36°28′50″	116°26′45″	230	S17 E49 15BBBB1	Steelman, James C.	L
AD-10	362525116274301	NA-9 Well	36°25′30″	116°27′40″	230	026N005E05E001S	USGS	L
AD-11	361954116181201	GS-3 Well	36°19′57″	116°17′52″	230	S19 E50 01BBD1	USGS	L
AD-12	362014116133901	GS-1 Well	36°20′21″	116°13′30″	230	S18 E51 34CBD1	USGS	L
AD-13	361724116324201	S-1 Well	36°17′20″	116°32′40″	230	025N004E21M001S	USGS	L
AD-14	361817116244701	Death Valley Jct Well	36°18′16″	116°24′47″	230	025N005E14M001S	Ettie, Lee	L
AM-1	362858116195301	Rogers Spring Well	36°28′55″	116°19′50″	230	S17 E50 10CDD1	USFWS	L
AM-1a	362924116203001	Fairbanks Spring	36°29′26″	116°20′28″	230	S17 E50 09AD1	USFWS	D
AM-2	362755116190401	Five Springs Well	36°27′55″	116°19′05″	230	S17 E50 23BBCA1	USFWS	D, L
AM-3	362555116205301	Garners Well	36°25′55″	116°20′55″	230	S17 E50 33CAAB1	Garner, George	L
AM-4	362532116172700	Devils Hole	36°25′32″	116°17′27″	230	S17 E50 36DC1	NPS	L
AM-5	362529116171100	Devils Hole Well	36°25′30″	116°17′15″	230	S17 E50 36DDC1	USFWS	L
AM-5a	362502116192301	Crystal Pool	36°25′15″	116°19′25″	230	S18 E50 03ADBA1	USFWS	D
AM-6	362432116165701	Point of Rocks North Well	36°24′30″	116°16′55″	230	S18 E51 07BBBB1	USFWS	L
AM-7	362417116163600	Point of Rocks South Well	36°24′20″	116°16′40″	230	S18 E51 07BDB1	USFWS	L
AM-8	362230116162001	Big Spring	36°22′29″	116°16′25″	230	S18 E51 19ACB1	USFWS	D
DV-1	362728116501101	Texas Spring	36°27′28″	116°50′11″	243	027N001E23BS01S	NPS	D
DV-2	362252116425301	Navel Spring	36°22′52″	116°42′53″	243	026N002E13FS01S	U.S. Borax & Chem. Corp.	D
DV-3	362230116392901	Travertine Point 1 Well	36°22′31″	116°39′32″	243	026N003E21L001S	U.S. Borax & Chem. Corp.	L

Table 2. Well-completion data at monitoring sites in Yucca Mountain region

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See section “Site Number” for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Accessible well depth: Well depths listed are as reported in sources listed in explanation for **Data source** (see below) or as measured by USGS personnel (noted with “s”). See section “Accessible Well Depth” for further discussion.

Casing diameter at land surface: Outside casing diameter of segment most prominent at land surface; rounded to nearest inch.

Top of open interval: Depth to top part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for **Data source** (see below). U, unknown, no data.

Bottom of open interval: Depth to bottom part(s) of well that can receive ground water from lithologic interval. Uncased borehole is designated open interval in this table. Open interval may be deeper than accessible well depth, which may reflect original drilled depth. As reported in sources listed in explanation for **Data source** (see below). U, unknown or no data.

Diameter of open interval: Inside casing diameter; rounded to nearest inch. Hole diameter is listed where no casing is present. U, unknown or no data.

Type of open interval: Description of open interval: P, perforated or slotted casing; S, screened casing, type not known; U, unknown, no data; X, uncased borehole.

Data source: D, Well driller’s log, well-completion report, or Fenix & Scisson, Inc., or Raytheon Services Nevada hole-history data; J. Johnston (1968); M, no source, data not available; O, owner of well; R, Robison and others (1988); T, Thordarson and others (1967).

Contributing units: Saturated lithologic interval yielding water to well: C, carbonate rock; F, valley fill; S, undifferentiated sedimentary rock; V, volcanic rock. See section “Contributing Lithologic Units” for further discussion.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
CF-1a	365445116383901	GEXA Well 3	700	7	208	313	6	P	D	S
					513	618	6	P		
					658	700	6	P		
CF-2	364732116330701	USW VH-1	2,501	10	911	912	9	X	R	V
					912	2,501	6	X		
CF-3	364105116302601	Cind-R-Lite Well	460	9	320	460	8	P	D	F
JF-1	365116116233801	UE-25 WT 15	1,360	11	127	130	15	X	D	V
					130	1,360	9	X		
JF-2	364945116235001	UE-25 WT 13	1,160	11	222	224	15	X	D	V
					224	1,150	9	X		
					1,150	1,160	8	X		
JF-2a	364938116252102	UE-25p 1 PTH	5,923	24	4,256	4,279	10	X	R	C
					4,279	5,900	7	X		
					5,900	5,923	6	X		
J-13	364828116234001	J -13 WW	3,488	13	996	1,301	13	P	T	V
					1,301	1,386	11	P		
					2,690	3,312	5	P		
					3,385	3,488	8	X		
J-11	364706116170601	J -11 WW	1,327	13	1,075	1,095	12	P	D	V
					1,242	1,298	12	P		

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval: Feet below land surface: Top	Open interval: Feet below land surface: Bottom	Open interval: Diameter (inches)	Open interval: Type	Data source	Contributing units
J-12	364554116232401	J -12 WW	1,139	13	793	868	12	P	D	V
					887	1,139	12	X		
J-13	364828116234001	J -13 WW	3,488	13	996	1,301	13	P	T	V
					1,301	1,386	11	P		
					2,690	3,312	5	P		
					3,385	3,488	8	X		
J-11	364706116170601	J -11 WW	1,327	13	1,075	1,095	12	P	D	V
					1,242	1,298	12	P		
J-12	364554116232401	J -12 WW	1,139	13	793	868	12	P	D	V
					887	1,139	12	X		
JF-3	364528116232201	JF- 3 Well	1,138	9	735	1,138	8	P	D	V
RV-1	363815116175901	TW- 5	800 s	7	735	800	6	P	T	S
					800	916	U	X		
MV-1	363530116021401	Army 1 WW	1,953	11	800	1,050	11	P	D	C
					1,368	1,370	10	X		
					1,370	1,684	9	X		
					1,684	1,953	7	X		
AD-1	364141116351401	NA-6 Well BGMW-10	960	2	930	940	2	S	D	F
AD-2	363830116241401	Airport Well	750 s	14	360	777	14	P	D	F
AD-2a	363835116234001	NDOT Well	495	9	395	495	8	P	D	F
AD-3a	363521116352501	Davidson Well	240 s	16	120	250	15	P	D	F
AD-4a	363428116234701	Cooks East Well	269 s	13	147	213	12	P	D	F
					238	286	12	P		
AD-5	363310116294001	USBLM Well	348 s	12	U	U	U	U	M	F
AD-6	363213116133800	Tracer Well 3	678 s	9	620	807	6	X	J	C
AD-7a	363009116302702	Blackman Well	210	7	U	U	U	U	O	F
AD-8	362929116085701	Cherry Patch Well	215 s	15	U	U	U	U	M	F
AD-9	362848116264201	Gilgans North Well	396 s	13	60	90	12	P	D	F
					154	244	12	P		
					245	396	15	X		
AD-10	362525116274301	NA-9 Well	1,090	2	1,063	1,066	2	S	D	F
AD-11	361954116181201	GS-3 Well	2,000	2	1,969	1,979	2	S	D	F
AD-12	362014116133901	GS-1 Well	1,580	2	1,549	1,559	2	S	D	F
AD-13	361724116324201	S-1 Well	2,000	2	1,969	1,979	2	S	D	F

Table 2. Well-completion data at monitoring sites in Yucca Mountain region—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Accessible well depth (feet below land surface)	Casing diameter at land surface (inches)	Open interval				Data source	Contributing units
					Feet below land surface		Diameter (inches)	Type		
					Top	Bottom				
AD-14	361817116244701	Death Valley Jct Well	225 s	12	160	200	12	S	D	F
AM-1	362858116195301	Rogers Spring Well	202 s	16	100	240	12	P	D	F
					240	420	16	X		
AM-2	362755116190401	Five Springs Well	123 s	14	0	100	13	P	D	C
					100	140	14	X		
					468	818	U	X		
AM-3	362555116205301	Garners Well	202 s	9	140	180	8	P	O	F
AM-5	362529116171100	Devils Hole Well	200 s	16	48	248	16	P	D	F
AM-6	362432116165701	Point of Rocks North Well	500	16	139	500	16	P	D	F
AM-7	362417116163600	Point of Rocks South Well	586 s	14	132	467	14	P	D	C
					468	818	U	X		
DV-3	362230116392901	Travertine Point 1 Well	650 s	5	100	970	5	X	D	C

U.S. Geological Survey Site Identification

Sites are identified by the standard U.S. Geological Survey identification number, which is based on an initial determination of latitude and longitude of the site. The site identification serves as a unique identification number in files and data bases of the USGS and indicates the approximate geographic location of each site. The identification consists of 15 digits: the first 6 digits denote the degrees, minutes, and seconds of latitude; the next 7 digits denote degrees, minutes, and seconds of longitude; and the last 2 digits (assigned sequentially) identify the site within a 1-second grid. For example, site 363530116021401 is at approximately 36°35′30″ N latitude and 116°02′14″ W longitude, and it is the first site recorded in that 1-second grid. Even if a more precise latitude and longitude are subsequently determined, the site identification number remains unchanged. Latitude and longitude shown for a site, therefore, are the most accurate locators.

Local Site Number

The local site number (table 1) is based on an index of hydrographic areas (Rush, 1968; Harrill and others, 1988) and on the rectangular subdivision of public lands referenced to the Mount Diablo base line and meridian for sites in Nevada, or San Bernadino base line and meridian for sites in California. Numbering conventions differ depending on whether a site is in Nevada or California.

For sites in Nevada, each local number consists of four units separated by spaces: The first unit is the hydrographic area number; the second unit is the township, preceded by an S to indicate location south of the base line; the third unit is the range, preceded by an E to indicate location east of the meridian; and the fourth unit consists of the section number and letters designating the quarter section, quarter-quarter section and so on (A, B, C, and D, indicate the northeast, northwest, southwest, and southeast quarters, respectively), followed by a number indicating the sequence in which the well was recorded. For example, site 230 S18 E51 34CBD1 is in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the southeast quarter of the northwest quarter of the southwest quarter of section 34, township 18 south, range 51 east, Mount Diablo base line and meridian.

For sites in California, the local number consists of the hydrographic area number followed by three spaces. The next 10 characters indicate the township and location north or south of the baseline, the range

and location east or west of the meridian, and the section number. The letter following the section number designates the 40-acre subdivision of the section in which the site is located (U.S. Geological Survey, 1996). The final letter indicates that the location is referenced to the San Bernardino (S) base line and meridian and is preceded by a 3-digit number (for wells) or an “S” and 2-digit number (for springs) indicating the sequence in which the site was recorded. For example, site 230 025N005E14M001S is a well in the Amargosa Desert (hydrographic area 230) and is the first site recorded in the 40-acre subdivision designated M of section 14, township 25 north, range 5 east, San Bernardino base line and meridian.

Data Type

Data type (table 1) identifies the types of data (water level and discharge) presented for each site. Ground-water-level data are in tables 5–7 and ground-water-discharge data are in table 8.

Accessible Well Depth

Accessible well depth (table 2) is the measurable depth to the bottom of the well. The drilled depth may be greater than the accessible depth of the well due to modifications of the well, obstructions, or accumulation of sediment at the bottom of the well. The depth of each well was measured by USGS (depths noted with “s”) or was reported by other data sources. The USGS measured depths less than 1,000 ft by “sounding” the bottom of the well with weighted steel or electric tapes.

Top and Bottom of Open Interval

Open intervals (table 2) are parts of the well that are open to the surrounding lithologic intervals and allow water to enter the well. An uncased section of a well is considered an open interval in this report.

Type of Open Interval

Type of open interval (table 2) is a physical description of the open intervals of a borehole. The types of openings are perforated or slotted casing, screened casing, and open hole with no casing.

Data Source

Data sources (table 2) are organizations or publications from which information on depth of well, open interval, and type of opening was obtained. Drillers’ logs or records are filed with the Nevada Division of Water Resources (NDWR) or maintained by the well owner. Fenix and Scisson, Inc., and Raytheon Services Nevada were contractors for DOE and maintained a summary of well-construction information for selected wells in the area. Publications are USGS reports written for DOE as part of cooperative studies associated with weapons-testing hydrology programs (Thordarson and others, 1967; Johnston, 1968) or Yucca Mountain site-characterization studies (Robison and others, 1988).

Contributing Lithologic Units

Contributing units (table 2) are the principal lithologic intervals at the site that yield water to the well. For purposes of this report, contributing units are one or a combination of four general types. Wells characterized as having a contributing unit of carbonate or volcanic rock are wells with open intervals in those consolidated rocks. In and near the Amargosa Desert, wells characterized as having a contributing unit of valley fill are those with open intervals in unconsolidated valley-filling materials, including lakebed deposits. Wells with open intervals in clastic rock (including argillite, limy sandstones and siltstones, or silty, sandy, and shaley limestones) are characterized as having a contributing unit of undifferentiated sedimentary rock.

Robison and others (1988) describe the contributing units at sites CF-2, JF-1, JF-2, JF-2a, and J-13. McKinley and others (1991) describe the contributing units for sites J-11, J-12, MV-1, AD-4a, AD-5, AD-6, AD-8, and AM-4. Thordarson and others (1967) describe the contributing unit at site RV-1. Dudley and Larson (1976) describe the contributing units for sites AM-2, AM-5, and AM-7. Contributing-unit data are not available from listed data sources for some wells; the contributing units indicated for those wells are derived from driller’s logs or well-completion reports that describe geology in the boreholes, open intervals in the wells, and measurements of depth to water.

Contributing units for springs (fig. 1) indicate sources of water discharged at the sites. Winograd and Thordarson (1975, p. C75–C97) describe sources of discharge at sites AM-1a, AM-5a, AM-8, and DV-1. McKinley and others (1991) describe the source of discharge at site DV-2.

DATA-COLLECTION PROCEDURES AND EQUIPMENT

Water-level and discharge data for monitoring sites were compiled from available sources, from USGS files and data bases, and from measurements made by U.S. Geological Survey Environmental-Monitoring Program (USGS-EMP) personnel. Data-collection procedures and equipment used by USGS-EMP are described in detail, and equipment used by other sources are described briefly. Water-use data are compiled from available sources as described in the section “Ground-Water Withdrawal Data.”

Periodic Water-Level Data

Periodic water-level measurements in table 5 are generally made during site visits, using one of the methods described in the section “Water-Level Measurements.” Supplemental information, including land-surface altitude, height of measurement point, method of measurement, site status, and source of data, are also listed in table 5.

Land-Surface Altitude and Height of Measurement Point

Land-surface altitude and height of the measurement point (MP) above (or depth below) land surface are included with periodically collected data in table 5. Land-surface altitude is a representative altitude of land at or near the site. An exception is site AM-4 (Devils Hole), where the land-surface altitude represents the altitude of the measurement point (a bolt fastened to the south wall of the fissure) that is not referenced to land surface. Land surveys were made by USGS personnel at the monitoring sites to determine the altitudes of land surface or the MP.

Heights of MP’s for sites in Amargosa Desert (except AM-4), Death Valley, and Rock Valley were determined by measuring the distance of the MP above (or depth below) a representative point on the land surface at or near the well. The altitude of the MP was determined during the USGS land survey, and land-surface altitude was computed by adding or subtracting the MP height from the surveyed MP altitude.

At sites JF-1, JF-2, JF-2a, and J-13, USGS land surveys verified previously reported land-surface and MP altitudes. At sites CF-2, J-11, and J-12, USGS land surveys verified the previously reported land-surface altitudes and determined the MP altitude by adding the height of the MP to the land-surface altitude. At sites CF-1a, and MV-1, USGS land surveys determined the land surface and MP altitudes. The height of the MP is the difference between the MP altitude and land-surface altitude. Land-surface altitudes are reported to the nearest tenth of a foot.

Depth to Water and Altitude of Water Surface

Depth to water, in feet below land surface, is computed as the measured depth to water below the MP minus the height of the MP above land surface at the well. The altitude of water surface is the depth to water subtracted from the altitude of land surface and is reported to the nearest tenth of a foot. At site AM-4, the depth to water represents depth below the MP and the altitude is the depth to water subtracted from the altitude of the bolt.

Water-Level Measurements

Periodic water-level measurements made by USGS-EMP personnel were completed using the procedures and equipment described in the following sections. Measurement methods by other sources also are briefly described.

Calibrated Electric Tape

USGS-EMP personnel used two calibrated 1,000-ft electric tapes and one calibrated 2,000-ft electric tape during 1999. Each tape was marked with a unique identifier (YMP-11, YMP-13 and PRT-3) for quality-assurance purposes. The electric tapes were calibrated using steel tapes. At depths less than 500 ft, the electric tapes were calibrated using a steel tape maintained by USGS-EMP personnel and identified as the 500-ft reference steel tape #1. At depths greater than 500 ft, the electric tapes were calibrated using the U.S. Geological Survey Site Characterization Project (USGS-SCP) 2,600-ft calibrated steel tape identified

by USGS-SCP as Chain #3. Selected calibration data for the electric tapes are summarized in table 3. Calibration data for tapes YMP-13 and PRT-3 presented in Locke (2001, table 3) are not repeated in this report.

The corrections to the USGS-SCP calibrated steel tape account for mechanical stretch and thermal expansion of the tape. No corrections were necessary for the USGS-EMP 500-ft reference steel tape #1 because mechanical stretch and thermal expansion of the tape are considered negligible at the depths to water measured. The correction factors for the electric tapes are the difference between the corrected steel-tape measurement and the uncorrected electric-tape measurement.

A summary of correction factors applied to USGS-EMP electric tapes for 1999 is listed in table 4. The correction factor is used to adjust depth-to-water measurements made with an electric tape to account for mechanical stretch, incorrect markings, and changes to the physical condition of the tape. The measurement period represents the time during which the correction factors were applied. Applied correction factors for 1999 usually are averages of individual correction factors; individual correction factors include discrete corrections presented in table 3 of this report and applied factors listed in table 4 of previous reports on selected ground-water data for the Yucca Mountain Region.

Applied correction factors for specific depth ranges are based on measurement periods in which differences of 0.05 ft or less are calculated between (1) the average of individual correction factors within a particular range of depths to water and (2) the individual correction factors within that range. For example, the -0.53 ft applied correction factor for tape PRT-3 (in the depth range 1,100–1,299 ft) is an average of the individual correction factors -0.54 ft, -0.50 ft, and -0.54 ft (table 3 and Locke, 2001, table 3). When an applied correction factor for a depth range cannot be derived accordingly, presumably due to an indeterminate change in the physical condition of a tape, the applied correction factor for a measurement period is calculated from a linear proration of factors determined for successive calibrations. Linear prorations of correction factors are applied by time and are represented by listing the beginning and ending factors separated by “to” in table 4.

Applied correction factors also may be based on measurement periods in which differences of 0.05 ft or less are calculated between (1) an average of factors for specific depth ranges (as derived above) and (2) all individual correction factors within those ranges. For example, the -0.04 ft applied correction factor for tape YMP-13 (in the 100–299 ft and 300–499 ft depth ranges in table 4) is an average of the -0.02 ft and -0.05 ft factors determined for each depth range and is within 0.05 ft of the individual correction factors -0.03, -0.02, -0.02, -0.03, -0.05, and -0.08 (table 3 and Locke, 2001, table 3).

Calibrated electric tapes were used at wells when frequent repetitive measurements were required due to fluctuating water levels, depths to water were greater than 500 ft, or wet conditions inside a well which prevented measurements using chalked steel tapes. Electric-tape measurements are made by lowering the end of the tape to the water surface until a signal is activated when a probe on the end of the tape contacts the water. The tape is raised and lowered slowly until the exact point of contact is located. While holding the tape on the MP, the depth to water below the MP is read from markings on the tape. At least two measurements are made during each site visit, and supplemental measurements are made if those two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to rapidly changing water levels, the measured depths and appropriate site status are recorded. Measurements using calibrated electric tapes are indicated by method “V” in table 5.

An example calculation of depth to water below land surface for a site, using USGS-EMP calibrated electric tape PRT-3, is shown below:

Location: JF-3
Date: February 3, 1999 Time: 0831
Tape ID: PRT-3 Correction factor: -0.31 ft
(for depths from 700 to 899 ft)

	Depth below MP 712.75 ft
Correction factor	-.31 ft
Corrected depth below MP	712.44 ft
Height of MP above land surface	-2.27 ft
Depth to water below land surface	710.17 ft

Water-level measurements were made with electric tapes by the U.S. Fish & Wildlife Service (USFWS) at sites AM-1, AM-5, AM-6, and AM-7 and by the Nevada Division of Water Resources (NDWR) at sites AD-7a and AD-9. All these measure-

Table 3. Electric-tape calibration data used to derive correction factors for calendar year 1999. Calibration data used to derive correction factors but not listed herein are presented in the previous report (Locke, 2001) on selected ground-water data for Yucca Mountain region

[USGS-EMP ST1, U.S. Geological Survey Environmental-Monitoring Program 500-ft reference steel tape #1; USGS-SCP ST3, U.S. Geological Survey Site-Characterization Project Chain #3 (steel tape); YMP-11, YMP-13, 1,000-ft electric tapes; PRT-3, 2,000-ft electric tape]

Date	Site number (fig. 1)	Tape used	Depth below measuring point		Correction (feet)
			Uncorrected (feet)	Corrected (feet)	
01-20-99	CF-2	USGS-SCP ST3	604.92	604.92	0.00
		YMP-11	605.03	604.92	-.11
01-21-99	J-12	USGS-SCP ST3	744.16	744.16	.00
		YMP-11	744.26	744.16	-.10
08-17-99	AD-5	USGS-EMP ST1	128.24	128.24	.00
		YMP-13	128.26	128.24	-.02
	AD-13	USGS-EMP ST1	375.42	375.42	.00
		YMP-13	375.47	375.42	-.05
	CF-2	USGS-SCP ST3	605.09	605.09	.00
		YMP-11	605.18	605.09	-.09
		YMP-13	605.23	605.09	-.14
		PRT-3	605.36	605.09	-.27
08-19-99	J-12	USGS-SCP ST3	744.08	744.08	.00
		YMP-11	744.18	744.08	-.10
		YMP-13	744.24	744.08	-.16
		PRT-3	744.43	744.08	-.35
	JF-2	USGS-SCP ST3	996.21	996.21	.00
		PRT-3	996.82	996.21	-.61
	JF-1	USGS-SCP ST3	1,161.94	1,161.94	.00
		PRT-3	1,162.44	1,161.94	-.50
01-10-00	AD-5	USGS-EMP ST1	128.58	128.58	.00
		YMP-13	128.60	128.58	-.02
	AD-13	USGS-EMP ST1	374.16	374.16	.00
		YMP-13	374.24	374.16	-.08
	CF-2	USGS-SCP ST3	604.98	604.98	.00
		YMP-11	605.10	604.98	-.12
		YMP-13	605.13	604.98	-.15
		PRT-3	605.26	604.98	-.28
01-11-00	J-12	USGS-SCP ST3	743.70	743.70	.00
		YMP-11	743.80	743.70	-.10
		YMP-13	743.88	743.70	-.18
		PRT-3	744.05	743.70	-.35
	JF-2	USGS-SCP ST3	995.87	995.87	.00
		PRT-3	996.56	995.87	-.69
	JF-1	USGS-SCP ST3	1,161.66	1,161.66	.00
		PRT-3	1,162.20	1,161.66	-.54

Table 4. Applied correction factors for electric tapes used during calendar year 1999. Correction factors for 1999 are based on calibration data listed in table 3 of this report and data listed in table 4 of the previous report on selected ground-water data for Yucca Mountain Region

[Symbol: —, no measurements made for given depth-to-water range during period specified]

Tape	Measurement period		Correction factors for indicated depth ranges (feet)					
	Start	End	100–299	300–499	500–699	700–899	900–1,099	1,100–1,299
PRT-3	01-26-99	08-19-99	—	—	-0.31	-0.31	-0.59	-0.53
PRT-3	08-20-99	01-11-00	—	—	-.31	-.31	-.59 to -.69	-.53
YMP-11	01-21-99	01-11-00	—	—	—	-.10	—	—
YMP-13	01-22-99	01-11-00	-0.04	-0.04	-.15	-.15	—	—

ments are listed with method “T” in table 5. Personnel from another USGS Nevada District program made a measurement at AD-1 with an electric tape.

Steel Tape

In 1999, USGS-EMP personnel maintained one 500-ft steel tape as a reference tape and used three field steel tapes (one 500-ft and two 300-ft tapes) for routine measurements. The steel tapes are uniquely marked (reference steel tape #1, ST-5, ST-6, and ST-7). The steel tapes were checked against the reference tape at several depths to water to verify their accuracy. No corrections to the measurements made with these steel tapes were needed in 1999.

General procedures for using 300- and 500-ft steel tapes are to (1) chalk the bottom section of the tape, (2) lower the tape into the well until part of the chalked section is below the water surface, (3) hold the tape on the MP and record the “hold” reading, (4) raise the end of the tape to the surface, observing the “cut” (top of the wet part of the chalked tape), (5) record the reading of the cut, (6) calculate the depth to water below the MP by subtracting the “cut” reading from the “hold” reading, and (7) calculate the depth to water below land surface by subtracting the height of the MP from the depth to water below MP. USGS-EMP personnel make a minimum of two measurements during each site visit to verify the initial measurement. Supplemental measurements are made if the two measured depths differ by more than 0.05 ft. If supplemental measurements indicate the difference is due to fluctuating water levels, the measured depths and appropriate site status are recorded.

USGS-SCP personnel made water-level measurements using calibrated steel tapes at sites CF-2, JF-1, JF-2, JF-2a, J-13, J-11, and J-12. Descriptions of the steel tapes, applicable corrections, and procedures used by USGS-SCP for making steel-tape measurements are given by Robison and others (1988, p. 6–11), Gemmell (1990, p. 8–12), O’Brien (1991, p. 8–13), O’Brien and others (1995, p. 4–7), Graves and others, (1996, p. 5–10), Tucci, O’Brien, and Burkhardt (1996, p. 5–8), and Graves and Goemaat (1998, p. 5–11). USGS-SCP steel-tape measurements were compiled from information provided by USGS-SCP (R.P. Graves and C.S. Savard, U.S. Geological Survey, written communs., 1999 and 2000). Corrected depth-below-MP measurements were provided by USGS-SCP personnel and converted to depth below land surface by USGS-EMP personnel by subtracting the height of the MP above land surface.

Water-level measurements were made with steel tapes by personnel from the NDWR at sites AD-7a and AD-9. All measurements using steel tapes are listed with method “S” in table 5.

Other

Site AD-14 was measured by personnel from another USGS Nevada District program with a ruled tape. This measurement is listed with method “N” in table 5.

Continual Water-Level Data

Two sites, JF-3 and AD-6, are instrumented by USGS-EMP to continually record ground-water level, atmospheric pressure, and battery voltage at 15-minute intervals. Instrumentation includes a gaged (vented) pressure sensor installed below the water surface, a barometer, and a data logger. Recorded data are processed to produce data on continual depth to water, atmospheric pressure, battery voltage, and daily average depth to water.

The pressure sensors at sites JF-3 and AD-6 transmit data to the data logger in pounds per square inch, which varies with the height of the water above the sensor. The range of output is 0 to 5.000 lb/in^2, which corresponds to a theoretical range of 0 to 11.53 ft of water above the pressure sensor. The general steps for installing and calibrating pressure sensors and processing pressure-sensor data are as follows:

1. Depth to water below MP is measured with a calibrated steel or electric tape and recorded on a field sheet. If a calibrated electric-tape measurement is made, a correction factor is applied. Depth to water below MP is used for pressure-sensor calibration, rather than depth to water below land surface, because a fixed point of reference is required.

2. The pressure-sensor cable is connected to a data logger and the sensor is lowered down the well until a substantial change in readings indicates the water surface has been reached.

3. The sensor is lowered to a set point and the pressure-sensor readings are recorded after the sensor equilibrates. The set-point depth of the sensor is determined by adding the depth-to-water measurement to the depth at which the sensor is installed below the water surface. For example, if the depth-to-water is 710 ft below the MP and the sensor is installed 5 ft below the water surface, the set-point depth is 715 ft. The sensor cable is marked or tagged at the MP. This mark or tag is used for making measurements when the pressure sensor is raised or lowered.

4. Following installation, the sensor is calibrated for a range of depths that spans the anticipated range of water-level fluctuation. Water-level fluctuations (differing depths to water below the MP) are simulated by raising and lowering the pressure sensor. Raising the sensor 1 ft above the set point will decrease the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft increase in depth to water. For example, if the depth to water is 710 ft below the MP (step 1) and the sensor is raised 1 ft, the simulated depth to water below the MP would be 711 ft ($710 + 1 = 711$ ft). Lowering the sensor 1 ft below the set point will increase the amount of submergence of the pressure sensor by 1 ft, thereby simulating a 1 ft decrease in depth to water. If the depth to water is 710 ft below the MP and the sensor is lowered 1 ft, the simulated depth to water below the MP would be 709 ft ($710 - 1 =$ 709 ft).

   The sensor is raised and lowered at 1/2-, 1-, or 2-ft intervals above or below the set point. The tag or marking placed on the sensor cable at the set point (step 3) provides a reference for measuring the distance the sensor is raised or lowered. After the sensor output has stabilized at each interval, the time, pressure readings from the data logger (in pounds per square inch), distance of sensor above or below the set point, and simulated depth to water are recorded on the field sheet. The sensor cable is marked or tagged at the measured intervals and later used for calibration checks.

5. Upon completion of pressure-sensor calibration, the sensor is returned to the set point and the time and pressure readings from the data logger are recorded on the field sheet. Another water-level measurement is made with a calibrated steel or electric tape and recorded to check for fluctuation of the water level during installation or calibration of the sensor.

6. Data recorded while calibrating the sensor are used to develop a regression equation to convert pressure readings to water level below MP. The pressure readings from the data logger and corresponding simulated depths below the MP are regressed using pressure (in pounds per square inch) as the independent variable and depth below the MP (in feet) as the dependent variable.

The applicable period for utilizing a particular regression equation (to convert pressure readings to depth to water below the MP) generally corresponds with calibrations at the beginning and ending of that period. In some cases, however, the applicable period for a regression equation does not correspond with successive calibrations; a period is selected that minimizes differences between reference measurements made during site visits and computed water levels at dates intermediate to the two calibrations.

Water-level measurements are made with a calibrated steel or electric tape when a continual monitoring site is visited. The pressure-sensor reading is recorded by the data logger at the time of the measurement. The reading is converted to depth to water, using the established regression equation, and recorded on a field sheet as computed water level. The steel tape or electric tape water-level measurement is used as a reference measurement and is compared to the computed value. Any difference between the reference measurement and computed value is applied as a correction to the continual record by linearly prorating the difference with time between consecutive visits to account for drift in pressure-sensor output.

Data are retrieved from the data logger using a portable computer, transferred to the USGS National Water-Information System (NWIS), and processed using data-base programs. The pressure-sensor data are converted to depths below land surface and stored in the data base. Daily average values are computed from the continual data and stored in the data base. Daily average depth-to-water values are used to compute daily average water-level altitudes, which also are stored in the data base.

Pressure-Sensor System at Site JF-3

Instrumentation has been installed at JF-3 since May 28, 1992, to continually collect water-level data every 15 minutes. The pressure sensor used to collect data in 1999 was installed on February 4, 1997. The sensor was recalibrated on February 3, 1999, and a new regression equation was developed: depth to water below land surface (ft) = (-2.346 × pressure reading) + 714.288 (ft). The coefficient of determination of the regression equation was 1.0. The equation was based on 12 points between pressure transducer and tape-down measurements. Pressure readings stored in the data base from January 1 to February 3, 1999, were converted to depth below land surface using this equation to minimize differences between reference measurements and computed water levels. Differences between reference measurements made with calibrated electric tapes and computed water levels, based on conversion of pressure readings during that period, ranged from -0.06 ft (January 25) to -0.08 ft (February 3).

On February 1, 2000, the sensor was recalibrated and a new regression equation was developed: depth to water below land surface (ft) = (-2.326 × pressure reading) + 714.152 (ft). The coefficient of determination of the regression equation was 1.0. The equation was based on 11 points between pressure transducer and tape-down measurements. This equation was used from February 3 to December 31, 1999, thereby minimizing corrections to computed water levels. The differences between a reference measurement made with a calibrated electric tape and a computed water level ranged from 0.01 ft (April 6) to -0.05 ft (October 5, 1999).

Depth-to-water measurements made with calibrated electric tapes during 1999 (table 5) ranged from 709.91 ft (January 25) to 710.28 ft (July 7) below land surface. The daily average water levels during 1999 (table 6) ranged from 709.68 ft (December 31) to 710.70 ft (February 11) below land surface.

Pressure-Sensor System at Site AD-6

Instrumentation has been installed at AD-6 since July 29, 1992, to continually collect water-level data every 15 minutes. The pressure sensor used to collect data in 1999 was installed on February 6, 1997. The sensor was recalibrated on February 3, 1999, and a new regression equation was developed: depth to water below land surface (ft) = (-2.332 × pressure reading) + 46.722 (ft). The coefficient of determination of the regression equation was 1.0. The equation was based on 11 points between pressure transducer and tape-down measurements. Pressure readings stored in the data base from January 1 to December 31, 1999, were converted to depth below land surface using this equation to minimize differences between reference measurements and computed water levels. Differences between reference measurements made with steel tapes and computed water levels, based on the conversion of pressure readings during that period, ranged from 0.00 ft (January 28, April 6, May 3, September 1, December 14) to -0.03 ft (July 3).

On February 18, 2000, the pressure sensor was recalibrated and a new regression equation was developed: depth to water below land surface (ft) = (-2.322 × pressure reading) + 46.676 (ft). The coefficient of determination of the regression equation was 1.0. The equation was based on nine points between pressure transducer and tape-down measurements. This equation was not used to convert any pressure readings made in 1999.

Depth-to-water measurements made with steel tapes during 1999 (table 5) ranged from 41.50 ft (May 3) to 41.82 ft (December 14) below land surface. The daily average water levels during 1999 (table 7) ranged from 41.45 ft (April 21) to 41.86 ft (February 11) below land surface.

Ground-Water Discharge Data

Measurements of ground-water discharge were collected and compiled for five springs and one flowing well (AM-2). Four of the sites, AM-1a, AM-2, AM-5a, and AM-8, are in the Ash Meadows spring-discharge area of the Amargosa Desert. The other two sites, DV-1 and DV-2, are in Death Valley. Discharge measurements were made by NPS, USFWS, and USGS-EMP. Periodic and monthly mean discharge data were determined by the use of current meters, flumes, and volumetric techniques.

The most commonly used method for measuring discharge, indicated by method "C" in table 8, was the vertical-axis current meter. This method is used to determine the average velocity of a partial section within a channel cross section. The average velocity within the partial section times the area of the partial section equals the discharge of that section. The summation of the discharges for all the partial sections is the total discharge in the channel. This method is described in more detail by Buchanan and Somers (1969).

Some discharge values were determined by measuring the depth of water inside a flume. The depth, or stage, is compared to an applicable stage-discharge relation for the flume to determine discharge. This method, indicated by method "F" in table 8, was used for site AM-1a. Determining discharges by the use of flumes is further described by Kilpatrick and Schneider (1983). Where an instrument has been installed to continually record stage in a flume, mean discharges can be computed for specific periods. This method is indicated in table 8 by method "Z" and was used for site DV-1, where monthly mean discharge (reported for the 15th of the month) was computed on the basis of daily data collected by NPS.

The volumetric method, indicated by method "V" in table 8, was used for measuring ground-water discharge from sites AM-2 and DV-2. A container was used to collect all discharge from the site while a stopwatch was used to determine the amount of time the discharge was collected. The container was positioned to collect the discharge and the stopwatch was started simultaneously. The container was removed, before it was overfilled, and the stopwatch was stopped simultaneously. The volume collected and elapsed time were determined; the discharge rate is the volume collected divided by the time. This procedure was repeated three times and an average rate was computed for each site visit.

The accuracy of the methods is directly related to the operational conditions of the equipment used and to the environmental conditions in which the equipment operated. Discharge values are reported to two significant figures. Discharge determined by all methods ranged from 0.90 gal/min at site DV-2 to 3,000 gal/min at site AM-5a for 1999 (table 8).

Ground-Water Withdrawal Data

Estimated ground-water withdrawals from wells for calendar year 1999 are presented in table 9 and historical annual withdrawals are presented in figures 10 and 11 by hydrographic area within the Alkali Flat–Furnace Creek Ranch and the Ash Meadows ground-water subbasins. Total ground-water withdrawal was determined for the Amargosa Desert, Crater Flat, Jackass Flats, and Mercury Valley hydrographic areas. The Amargosa Desert spans both subbasins and is subdivided into two areas within the Ash Meadows ground-water subbasin.

Withdrawals were estimated from compiled data supplied by public agencies including DOE, USGS, and NDWR. Ground-water withdrawals also were compiled from information provided by Bechtel Nevada.

Estimated annual ground-water withdrawals are based solely on available data and may be underestimated. Only when most of the withdrawals for an area were available, was an estimate made. In figures

10 and 11, the years that have no data reflect that an estimate could not be made, rather than an estimate of no ground-water withdrawal.

Withdrawals from Alkali Flat–Furnace Creek Ranch Ground-Water Subbasin

Withdrawals from the Amargosa Desert hydrographic area within the Alkali Flat–Furnace Creek Ranch ground-water subbasin were recompiled from ground-water pumpage inventories taken by NDWR. The pumpage inventories were for the entire Amargosa Desert during 1999, and include estimated withdrawals for irrigation, mining, quasi-municipal and commercial, and domestic uses. All reported withdrawals for mining use are from the Alkali Flat–Furnace Creek Ranch ground-water subbasin. Almost all reported withdrawals for irrigation (about 99.9 percent) and quasi-municipal and commercial uses (about 99.6 percent) in the Amargosa Desert are also from the Alkali Flat–Furnace Creek Ranch ground-water subbasin. Reported domestic use is based on the number and location of wells drilled for domestic purposes, as stored in data bases maintained by NDWR (Robert A. Coache, Nevada Division of Water Resources, oral commun., 2000); about 84.6 percent of all domestic use is from the part of the Amargosa Desert within this subbasin.

Withdrawals from Crater Flat were determined from totalizing flowmeters at Gexa Well 4 (about 1.6 mi northeast of site CF-1a), well Daisy PW-2 (about 1.8 mi northeast of site CF-1a), USW SD-6 (about 6.0 mi northeast of site CF-2), and site CF-3. Withdrawals from Gexa Well 4, well Daisy PW-2 and CF-3 are based on information from NDWR (Tim Wilson, Nevada Division of Water Resources, written commun., 2000). Withdrawals from well USW SD-6 are based on quarterly pumpage reports provided by DOE (Wendy Dixon and Scott Wade, U.S. Department of Energy, written communs., 1999 and 2000). Data on withdrawals from well USW VH-2 (about 1.5 mi northwest of site CF-2) were not available, although ground water is known to have been pumped from that well during 1999.

Withdrawals from Jackass Flats were determined from totalizing flowmeters at sites J-13, J-12 and well UE-25c #3 (about 2.5 mi northwest of site J-13). Withdrawals at sites J-13 and J-12 were recompiled from flowmeter readings supplied by Bechtel Nevada as part of the USGS Hydrologic Resources Management Program (David B. Wood, U.S. Geological Survey, written commun., 2000). Withdrawals from well UE-25c #3 are based on quarterly pumpage reports provided by DOE (Wendy R. Dixon and Scott A. Wade, U.S. Department of Energy, written communs., 1999 and 2000).

Withdrawals from Rock Valley are considered non-existent. The valley is within the Nevada Test Site, which limits public access and use. No DOE water supply wells are within the valley. Only one well (MV-1) is listed in the NDWR well data base and this well is not used.

Withdrawals from Ash Meadows Ground-Water Subbasin

Withdrawals from Mercury Valley were recompiled from flowmeter readings supplied by Bechtel Nevada for site MV-1 as part of the USGS Hydrologic Resources Management Program (David B. Wood, U.S. Geological Survey, written commun., 2000).

The Amargosa Desert within the Ash Meadows ground-water subbasin has been divided into two parts to provide information on withdrawals in the immediate vicinity of the environmentally sensitive Ash Meadows area; they are identified in table 9 and figure 11 as the Amargosa Desert (excluding Ash Meadows area) and the Amargosa Desert (Ash Meadows area). No withdrawals were reported for mining use from these two areas of the Amargosa Desert. Withdrawals for irrigation and quasi-municipal use in the Amargosa Desert (excluding Ash Meadows area) include withdrawals from two wells located in T. 17 S., R. 52 E. Withdrawals for quasi-municipal and commercial use from the Amargosa Desert (Ash Meadows area) include withdrawals from two wells located in T. 18 S., R. 50 E. Withdrawals for domestic use from the two areas of the Amargosa Desert were about 13.5 and 1.9 percent, respectively, of total reported domestic use in the entire Amargosa Desert hydrographic area during 1999; estimates of domestic use are based on the number and location of wells drilled for domestic purposes (as stored in data bases maintained by NDWR).

Quality Assurance

Stringent quality assurance is done for all work pertaining to Yucca Mountain studies to establish adequate confidence in the reliability of data collection, processing, and reporting. In the context of this data-collection program, quality assurance is defined as all planned or systematic actions designed to provide data and records of a desired quality. A variety of quality-control procedures, which are the operational techniques and activities used to meet the required quality objectives, have been implemented.

The numerous management and administrative procedures that control processing, record keeping, and reporting of data by USGS-EMP are not detailed in this report. Generally, data such as location, date and time of determinations, and field measurements are recorded onsite. Those data are reviewed for completeness and accuracy, stored in project files and data bases, and are subsequently included in publications by the USGS. Following publication, data are stored in a comprehensive record-keeping facility maintained by contractors for DOE.

In addition to standard USGS practices and the procedures previously described, formal unpublished technical procedures associated with the Yucca Mountain Site Characterization Project have been developed for the collection of water-level and discharge data. Those technical procedures include equipment tests and calibrations and measurement techniques to ensure that necessary and expected precision and accuracy are attained. The principal technical procedures that control the collection of data by project personnel are listed in La Camera and Westenburg (1994, p. 17).

PRESENTATION OF GROUND-WATER DATA

Tables included in this report generally list only 1999 ground-water data, whereas figures 2–13 show data for selected periods of record to illustrate changes in ground-water resources through time. Exceptions are tables 3, 4, and 10; tables 3 and 4 include data from 2000 used to determine correction factors for electric-tape measurements made during 1999, and table 10 includes a summary of historical water-level measurements at monitoring sites in Jackass Flats. Below is a description of the content of the tables and figures presented in this report.

Tables 5–9 list ground-water data that have been collected and compiled in the Yucca Mountain region as part of this study. Figures 2–11 are hydrographs and other graphical representations of selected data from the tables in this and previous reports on selected ground-water data for the Yucca Mountain region. Tables 5–9 and figures 2–11 are included at the back of this report.

Pumping water from or injecting water into a well or nearby well may result in short-term variations in water levels that differ from long-term or sustained ground-water levels. Observations about such activities (noted by field personnel during site visits) and corresponding water levels, which may represent short-term conditions, are recorded under “site status” in table 5. Data which may reflect short-term conditions, however, are excluded from the figures that show variations in water level through time.

Table 5 lists periodic measurements of depth to water and water-level altitude at 35 sites (including a flowing well) for 1999. Periodical data are from manual onsite measurements of depth to water. Data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Figures 2–5 show water levels listed in this report and previous reports on selected ground-water data for the Yucca Mountain region. Data for wells with primary contributing units of carbonate rock, volcanic rock, valley fill, and undifferentiated sedimentary rock are presented.

Tables 6 and 7 list daily average water levels at sites JF-3 and AD-6, respectively, for 1999. The daily average water levels are computed from continual water levels recorded by instrumentation at 15-minute intervals.

Figure 6 shows daily average water-level altitude and depth to water for sites JF-3 and AD-6. Daily averages are calculated on the basis of continually collected data listed in tables 6 and 7 of this report and in previous reports on selected ground-water data for the Yucca Mountain region. Data are presented for 1992 through 1999.

Table 8 lists periodic measurements of ground-water discharge at six sites for 1999. Discharge measured at site AM-2 represents a combination of flow directly through slotted casing near land surface and leakage from the casing’s annular space. Data for site DV-1 reported with data source “NPS” represent monthly average discharge collected from instrumen-

tation operated by the National Park Service. Discharge data collected by other agencies or programs are subject to revision upon further review by that agency or program.

Figure 7 shows measurements of ground-water discharge at sites AM-1a, AM-5a, and AM-8 through 1999, as listed in this and previous reports on selected ground-water data for the Yucca Mountain region.

Figures 8 and 9 show measurements of ground-water discharge through 1999 at sites AM-2 and DV-2, and DV-1, respectively, listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Periodic USGS measurements for 1990, 1991, and 1992 that were tabulated by La Camera and Westenburg (1994, table 5) have been revised to reflect water previously unaccounted for at site DV-1.

Table 9 shows estimates of annual ground-water withdrawals from wells in the Yucca Mountain region for 1999. Estimated annual ground-water withdrawals are based solely on available data. Information on withdrawals provided by other agencies or programs are subject to revision upon further review by that agency or program. Ground-water withdrawals, in millions of gallons and in acre-feet, from water-supply wells are grouped by ground-water subbasin and totaled by hydrographic area (or part of a hydrographic area) for calendar year 1999.

Figures 10 and 11 show estimates of annual ground-water withdrawals listed in this and previous reports on selected ground-water data for the Yucca Mountain region. Shown are withdrawals for areas with available data within the Alkali Flat–Furnace Creek Ranch and Ash Meadows ground-water subbasins, respectively, through 1999. In each hydrographic area, ground water may have been withdrawn in years for which no estimates are available and thus no bars are shown. Total bar height equals the approximate sum of withdrawals from all areas within the subbasin for given year.

DISCUSSION OF GROUND-WATER LEVELS AND GROUND-WATER WITHDRAWALS IN JACKASS FLATS

Ground water is withdrawn from Jackass Flats to support several DOE activities (including site characterization); if those withdrawals affect ground-water levels, the effects may be detected in Jackass Flats before they are detected elsewhere within the Yucca Mountain region. This section discusses data on ground-water levels and ground-water withdrawals in Jackass Flats. Changes in water-level altitudes at a particular site through time (discussed in the text near the end of this section) are described in order of increasing distance away from water-supply wells J-13 and J-12.

Figure 12 shows water-level altitudes for seven wells in Jackass Flats and estimated annual ground-water withdrawals in Jackass Flats from 1983 through 1999. Prior to 1983, available data on ground-water withdrawals in Jackass Flats generally represent only the withdrawals from well J-12 rather than total withdrawals from Jackass Flats. For greater consistency and comparability of data on water-level altitudes, water levels in wells J-13, J-12, and JF-3 that may have been affected by pumping or recent pumping of the well (water-level measurements associated with site status “P” or “R”) are excluded from figure 12.

Water-level altitudes presented are based on periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half a year). Water level data for all sites, prior to 1985, are based on periodic measurements made during site visits (and not daily averages). In addition, the data for sites JF-1, J-13, J-11, and J-12 since 1985, for site JF-2 since 1994, and for site JF-3 prior to May 1992 also are based on periodic measurements made during site visits. Daily average water levels from the U.S. Geological Survey Site Characterization Program (R.P. Graves and J.M. Gemmell, U.S. Geological Survey, written communs., 1995–98) are presented in figure 12 for site JF-2 from 1985 to 1993 and for site JF-2a from 1985 to 1997. Continual data collection at site JF-2 was discontinued in June 1994 but only periodic water levels are shown following December 1993. Continual data collection at site JF-2a was discontinued in October 1997 and only periodic water levels are shown following October 1997. Daily average water levels are also shown for site JF-3 from May 1992 to December 1999; long-term monitoring and continual data collection at this site began in May 1992.

Total ground-water withdrawals in Jackass Flats during 1999 consisted primarily of combined pumpage from water-supply wells J-13 and J-12 and test well UE-25c #3 (about 2.5 mi northwest of well J-13), all of which penetrate volcanic rock. About 27.3, 5.7, and 0.3 Mgal, respectively, were withdrawn from

these wells during 1999. Total ground-water withdrawals in Jackass Flats, from 1983 to 1999, are from data presented in this and previous reports on selected ground-water data for the Yucca Mountain region.

Total ground-water withdrawals from Jackass Flats during 1999 were about 33.3 Mgal. This amount is about 32 percent less than withdrawals during 1998 (48.8 Mgal) and about 36 percent less than the median withdrawal for 1983 to 1991 (52 Mgal) (La Camera and Westenburg, 1994, p. 30). Ground-water withdrawals in Jackass Flats increased from 38.9 Mgal in 1992 to 127.4 Mgal in 1996, and then decreased to 33.3 Mgal in 1999.

Table 10 contains selected statistics derived from data shown in figure 12 for water-level altitudes in Jackass Flats. Data for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 are summarized for the selected baseline periods and for subsequent calendar years through 1999. The table shows the number of measurements; minimum, maximum, and median water-level altitude; and the average deviation of measured water-levels from the median water level for each period.

To minimize effects of variability in measurement frequency on median water-level altitudes calculated for the period prior to 1992, the selection of a baseline period for each site was based on (1) the maximum number of consecutive years for which water-level measurements are available and (2) consecutive years containing similar frequencies of water-level measurements. For consistency, the baseline period selected at instrumented wells JF-2 and JF-2a was the period following installation of continual recorders. The baseline period for JF-3 was based solely on the availability of daily average water levels from the continual data recorder, which was installed in May 1992. These baseline periods are the standard to which following years are compared.

The median water-level altitudes shown in table 10 indicate a statistically representative ground-water level for a particular time. Median water-level measurements are listed because the calculated median is less affected by a few high or low values than the arithmetic mean. When more than half a year of continual data at a site were available (recorded hourly or more frequently by instrumentation), the median daily average water level is listed.

The average deviation indicates the dispersion of individual measurements about the median; it provides an indication of how precisely the median approximates a typical water-level altitude during the period. The average deviation equals the sum of the absolute differences between individual measurements and the median, divided by the number of individual measurements.

Figure 13 shows the median water-level altitudes and the average deviation of the water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3 for baseline periods and for subsequent years through 1999. Median annual ground-water withdrawal in Jackass Flats for 1983–91 and estimated annual withdrawals for subsequent years through 1999 are also included in figure 13. Selected information presented in the figure is summarized in the following discussion.

Median water-level altitude in water-supply well J-13 is 2,390.0 ft above sea level for the baseline period and for 1999. Median water-level altitude in well J-13 increased 0.2 ft from 1998 to 1999. Ground-water withdrawals from well J-13 declined from 42.5 Mgal in 1998 to 27.3 Mgal in 1999.

Median water-level altitude in water-supply well J-12, which is 3.0 mi south of J-13, is 2,388.3 ft for the baseline period and for 1999. Median water-level altitude in well J-12 increased 0.3 ft from 1998 to 1999. Ground-water withdrawals from well J-12 increased from 5.1 Mgal in 1998 to 5.7 Mgal in 1999.

Median water-level altitude in well JF-3, which is 0.5 mi south of water-supply well J-12, is 2,388.3 ft for the baseline period. Median water-level altitude for 1999 in well JF-3 was 2,388.2 ft, which is 0.1 ft lower than the median for the baseline period but 0.2 ft higher than the median for 1998. The change in median water-level altitude between the baseline period and 1999 is equal to the average deviation of the median for the baseline period (as indicated by the average deviation for 1992–93).

At wells J-13, J-12, and JF-3 (which penetrate volcanic rock and also are at or near principal points of ground-water withdrawals from volcanic rock) the 1999 median water-level altitudes are either equal to their baseline medians or are within the historical variability of their medians (represented by the average deviation of their respective baseline periods). The 1999 median water-level altitude in each well is 0.2–0.3 ft higher than their 1998 median altitudes.

Median water-level altitude in well JF-2, which penetrates volcanic rock about 1.4 mi north of water-supply well J-13, is 2,392.1 ft for the baseline period. Median water-level altitude in well JF-2 for 1999 was

2,392.5 ft, which is 0.4 ft higher than the median for the baseline period and the median for 1998. The average deviation of water levels during the baseline period from 1985 to 1991 (0.3 ft) is less than the changes in the median water levels.

Median water-level altitude in well JF-2a, which penetrates carbonate rock about 2.0 mi northwest of supply well J-13, is 2,468.6 ft for the baseline period. The median water-level altitude for 1999 was 2,470.2 ft, which is 1.6 ft higher than the median for the baseline period and 0.2 ft higher than the median for 1998. The increase in water level between the baseline period and 1999 is greater than the average deviation of the median water-level altitude for the baseline period from 1985 to 1991 (0.4 ft). Median water levels in well JF-2a have risen 0.1–0.3 ft per year since 1992.

Median water-level altitude in well JF-1, which penetrates volcanic rock about 3.2 mi north of the water-supply well J-13, is 2,392.5 ft for the baseline period. Median water-level altitude in well JF-1 for 1999 is 2,392.7 ft, which is 0.2 ft higher than the median for 1998 and the median for the baseline period. The average deviation of the median for the baseline period from 1985 to 1991 (0.2 ft), is equal to the change in the median between the baseline period and 1999.

Median water-level altitude in well J-11, which penetrates volcanic rock about 6.3 mi east of water-supply well J-13, is 2,402.2 ft for the baseline period. Median water-level altitude in well J-11 for 1999 was 2,402.4 ft, which is 0.2 ft higher than the baseline median and 0.2 ft lower than the median for 1998. The average deviation of the median for the baseline period from 1990 to 1991 (0.1 ft), is less than the change in the median between the baseline period and 1999.

In summary, the 1999 estimated ground-water withdrawal in Jackass Flats was about 33.3 Mgal. Withdrawals averaged about 52 Mgal from 1983 to 1991 and about 48.8 Mgal in 1998. The 1999 median water-level altitudes were determined for seven wells. For each well the 1999 median water-level altitude was compared to its baseline and 1998 median water-level altitude. The 1999 median water-level altitudes for six of the seven wells were either equal to or (0.2–1.6 ft) greater than their respective baseline medians. The median water-level altitude of well JF-3 was 0.1 ft less than its 1992–93 baseline median. From 1998 to 1999, the median water-level altitudes in six of the wells increased from 0.2 to 0.4 ft, but the median water-level altitude in well J-11 declined 0.2 ft.

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BASIC DATA

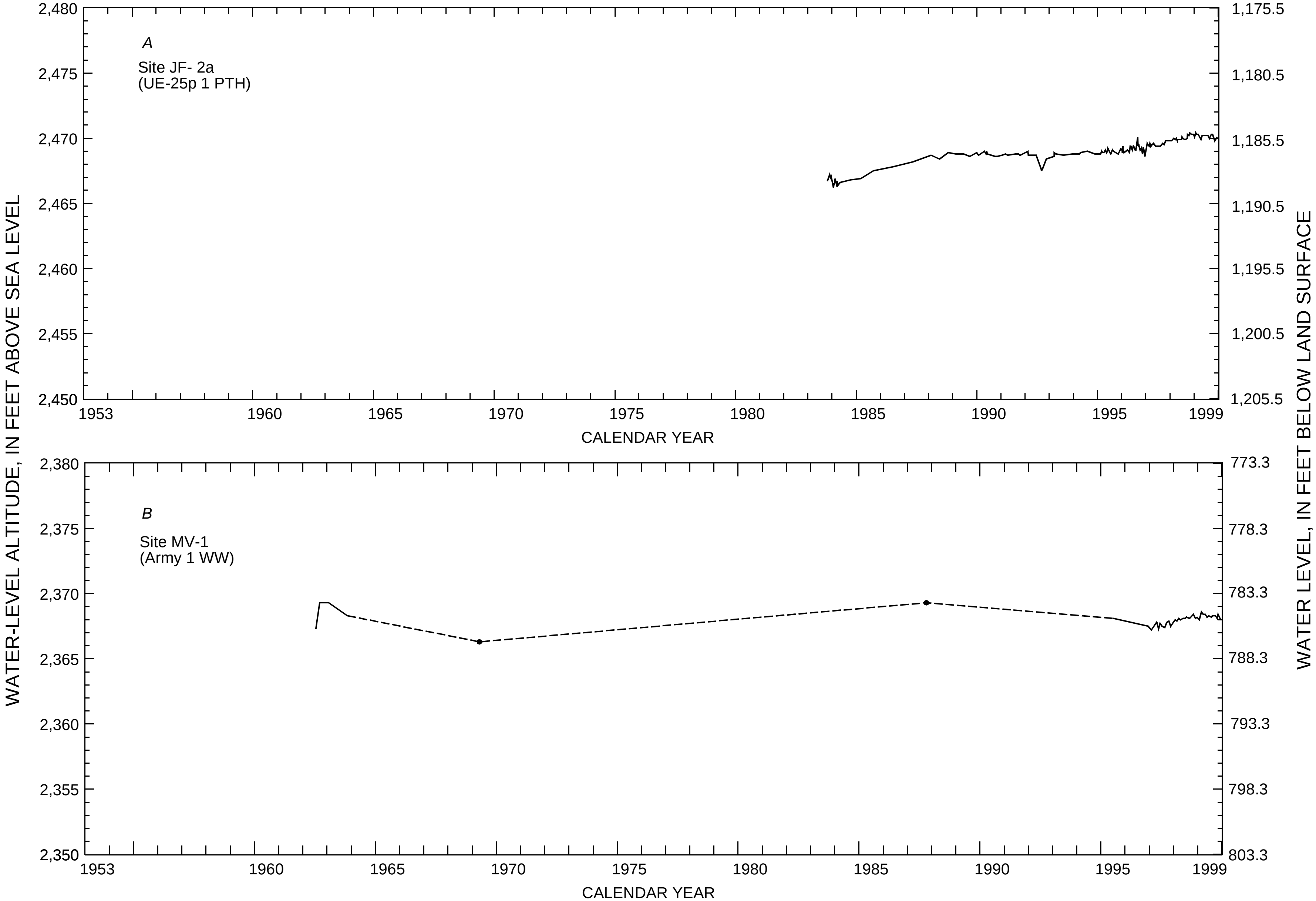
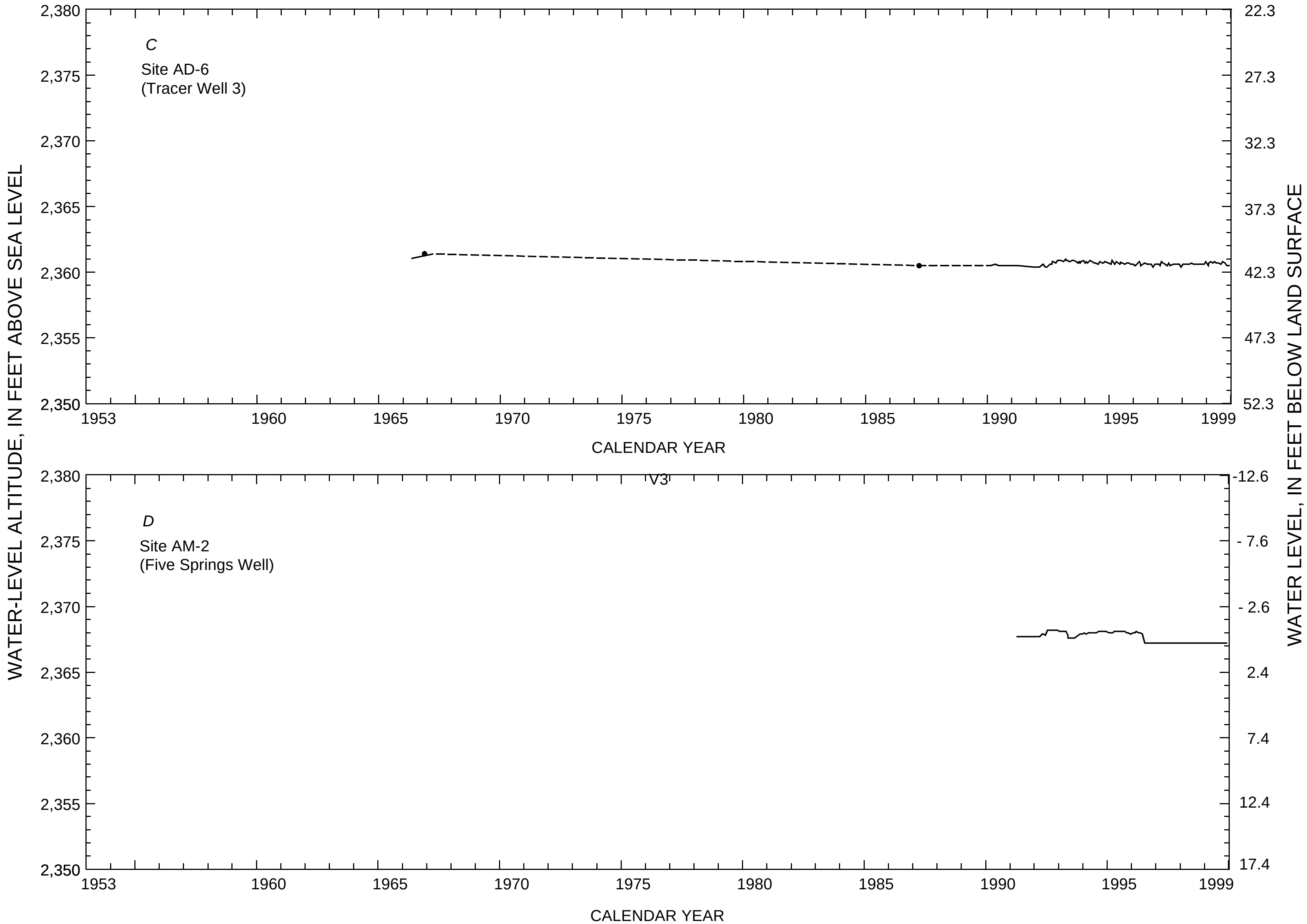


Figure 2. Periodic water levels through 1999 for selected sites at which primary contributing units are carbonate rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see section “Presentation of Ground-Water Data”).



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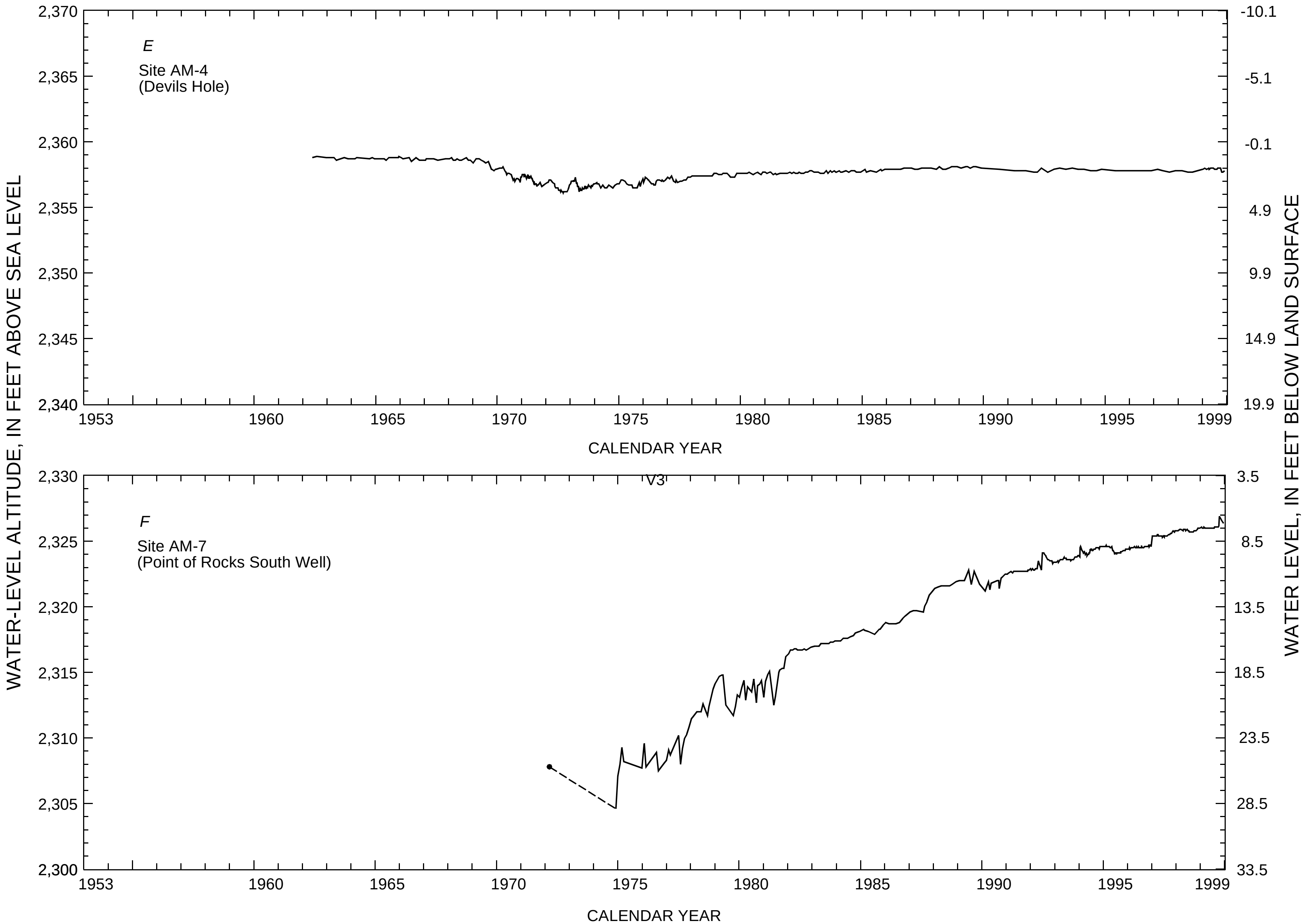

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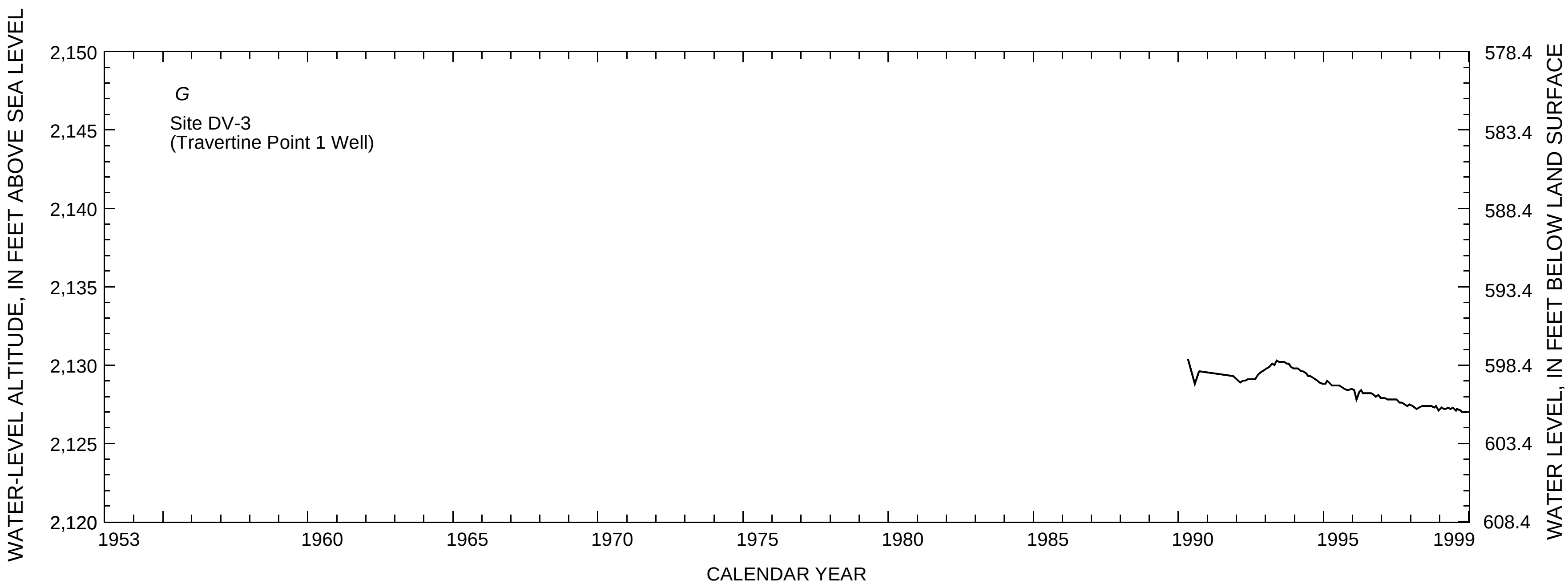

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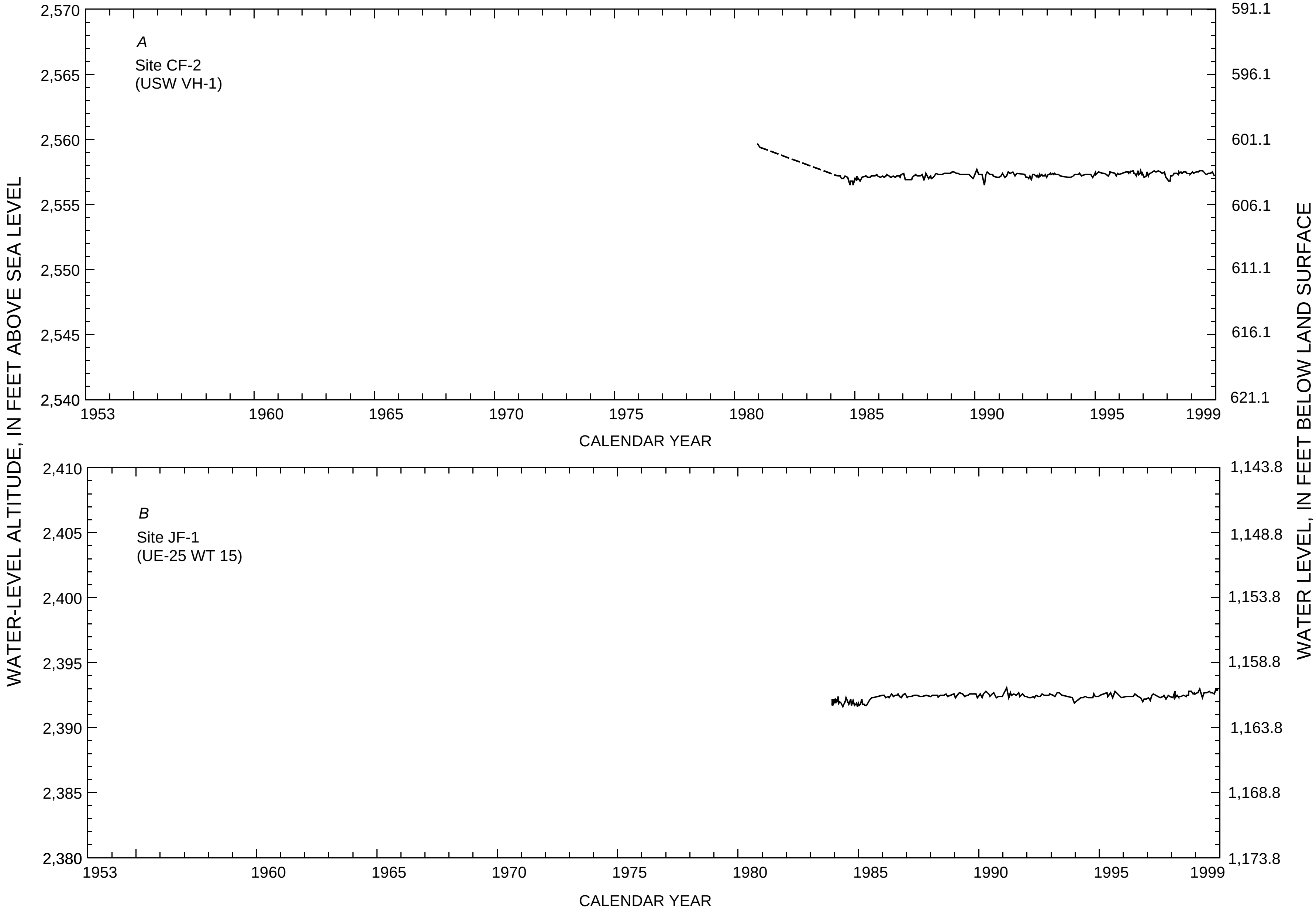
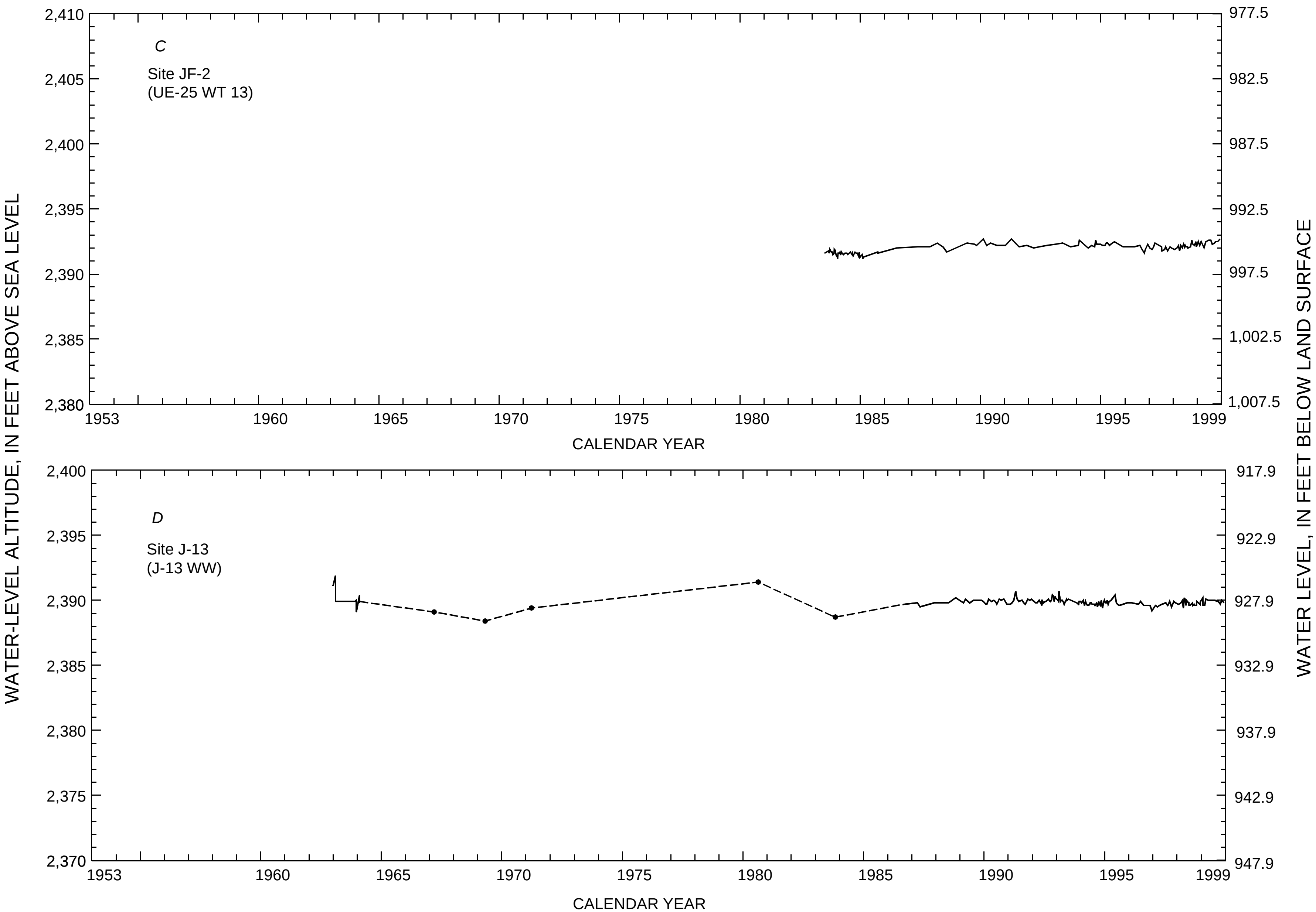


Figure 3. Periodic water levels through 1999 for selected sites at which primary contributing units are volcanic rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see section "Presentation of Ground-Water Data").



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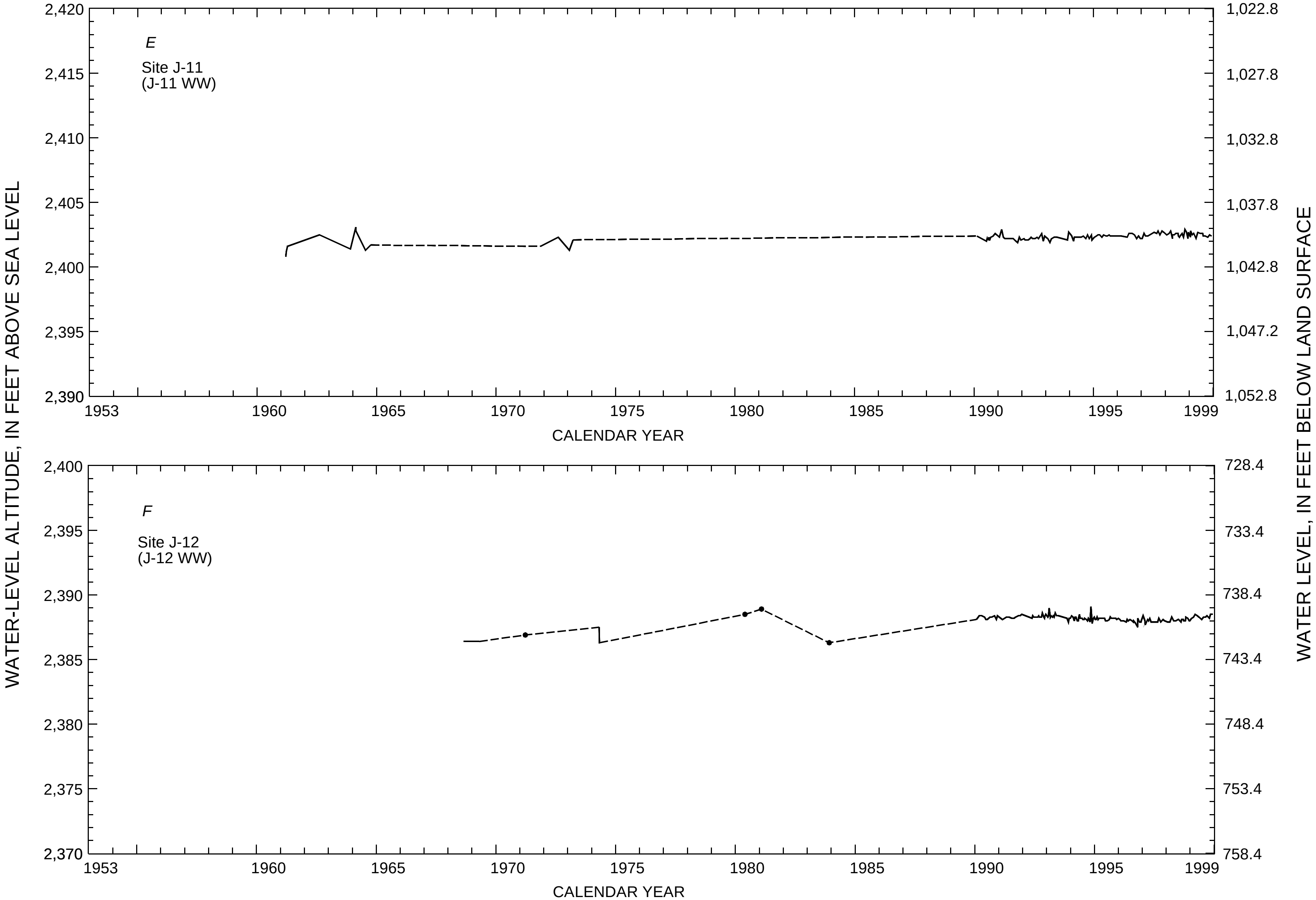

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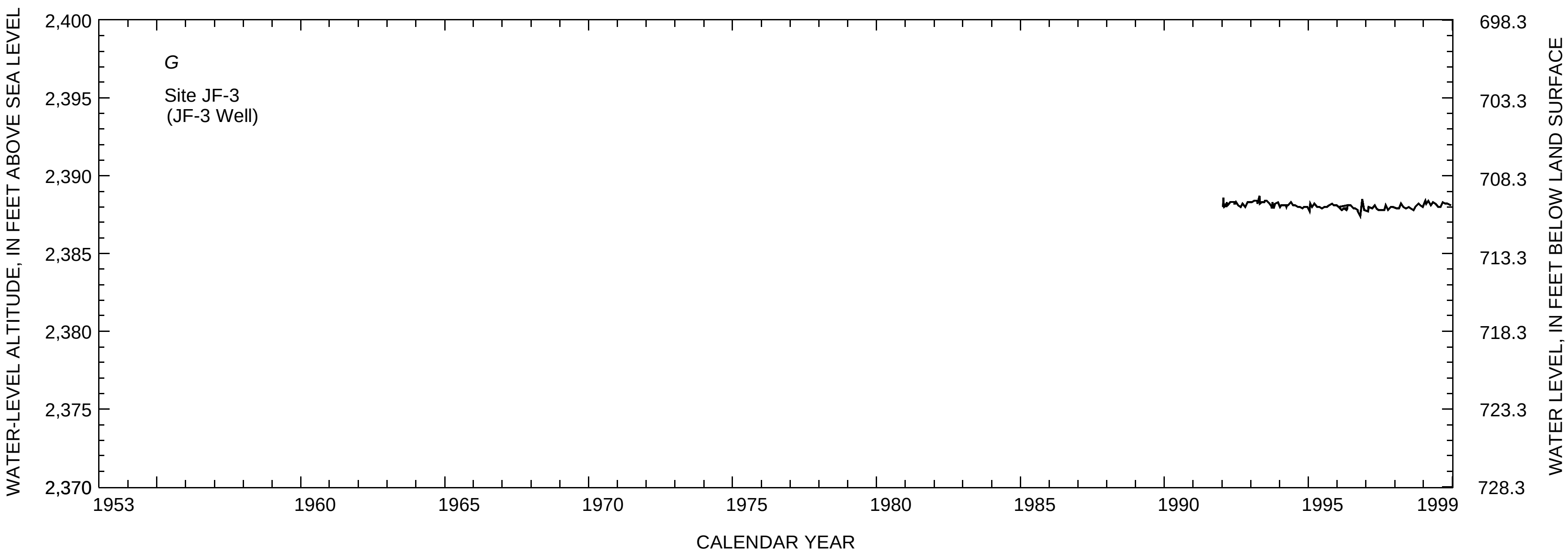

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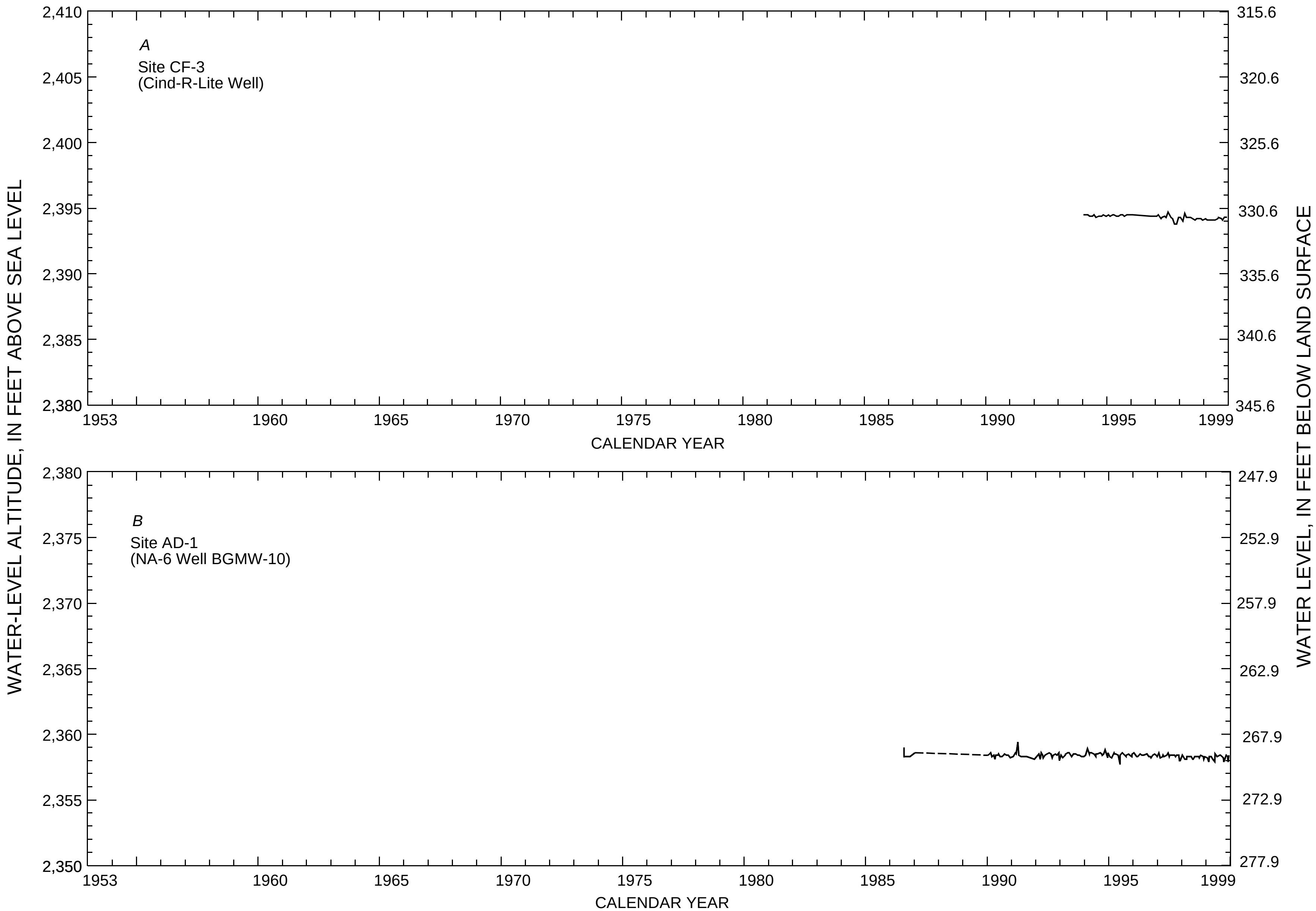
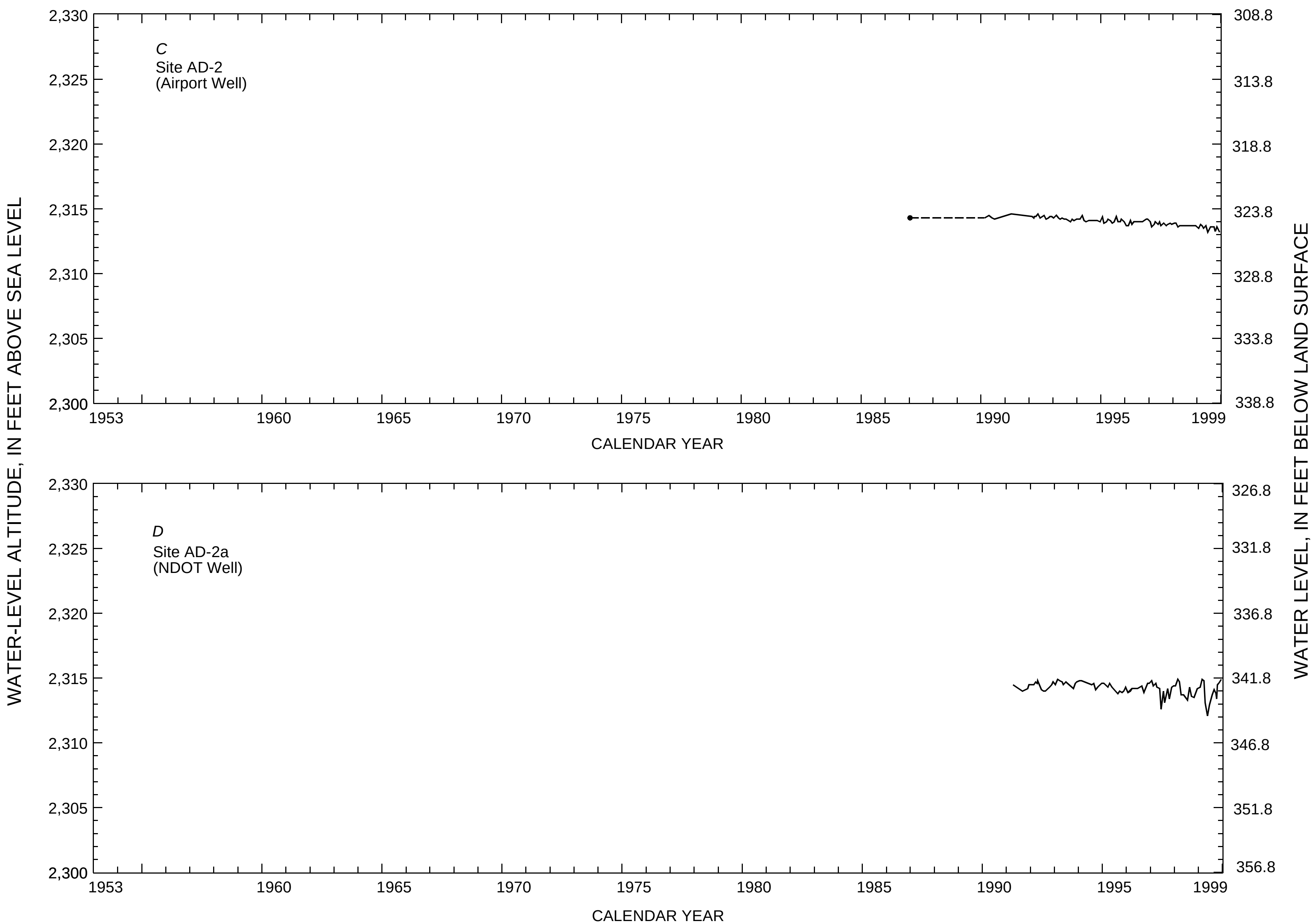


Figure 4. Periodic water levels through 1999 for selected sites at which primary contributing units are valley fill. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see section "Presentation of Ground-Water Data").



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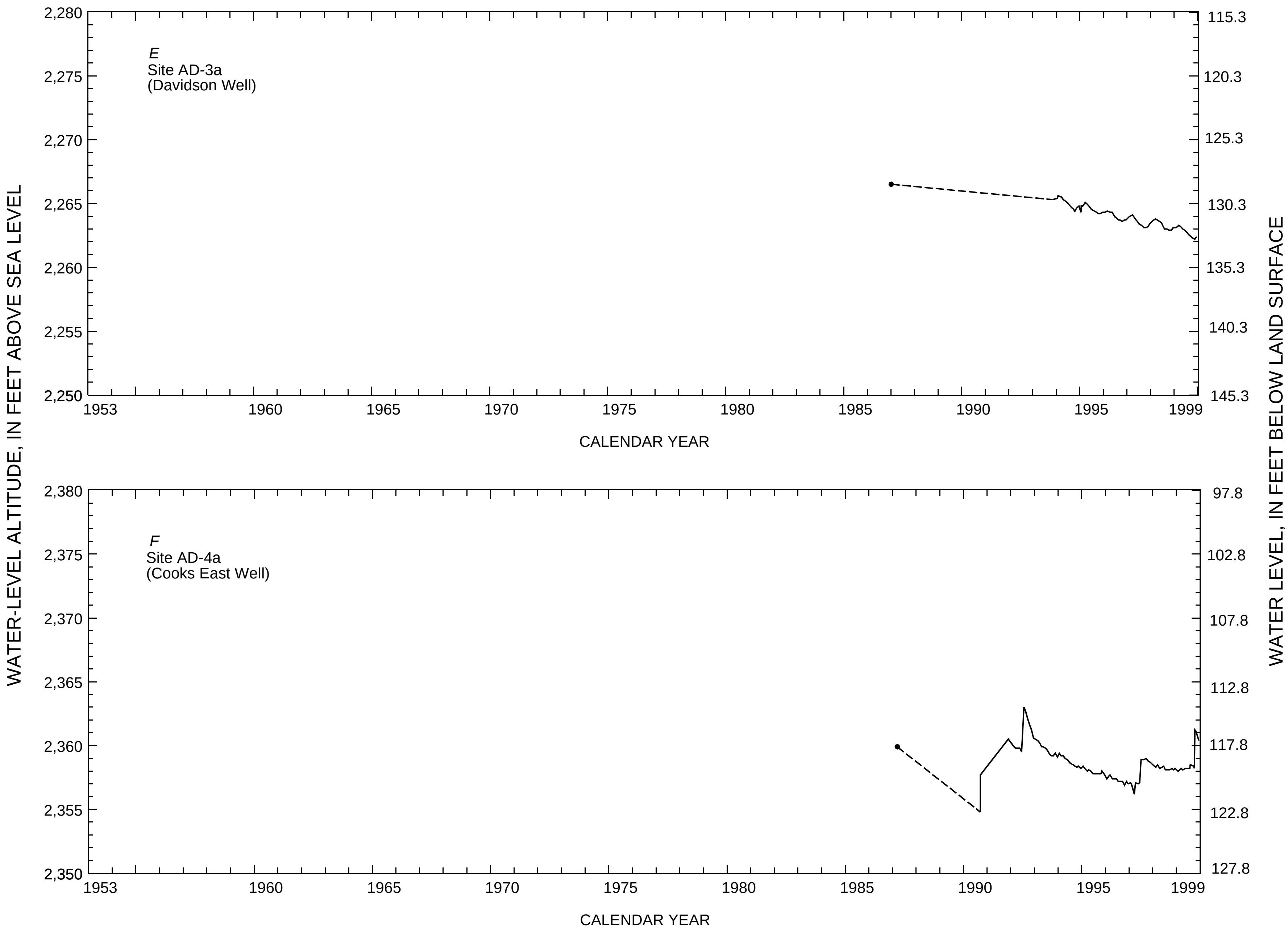

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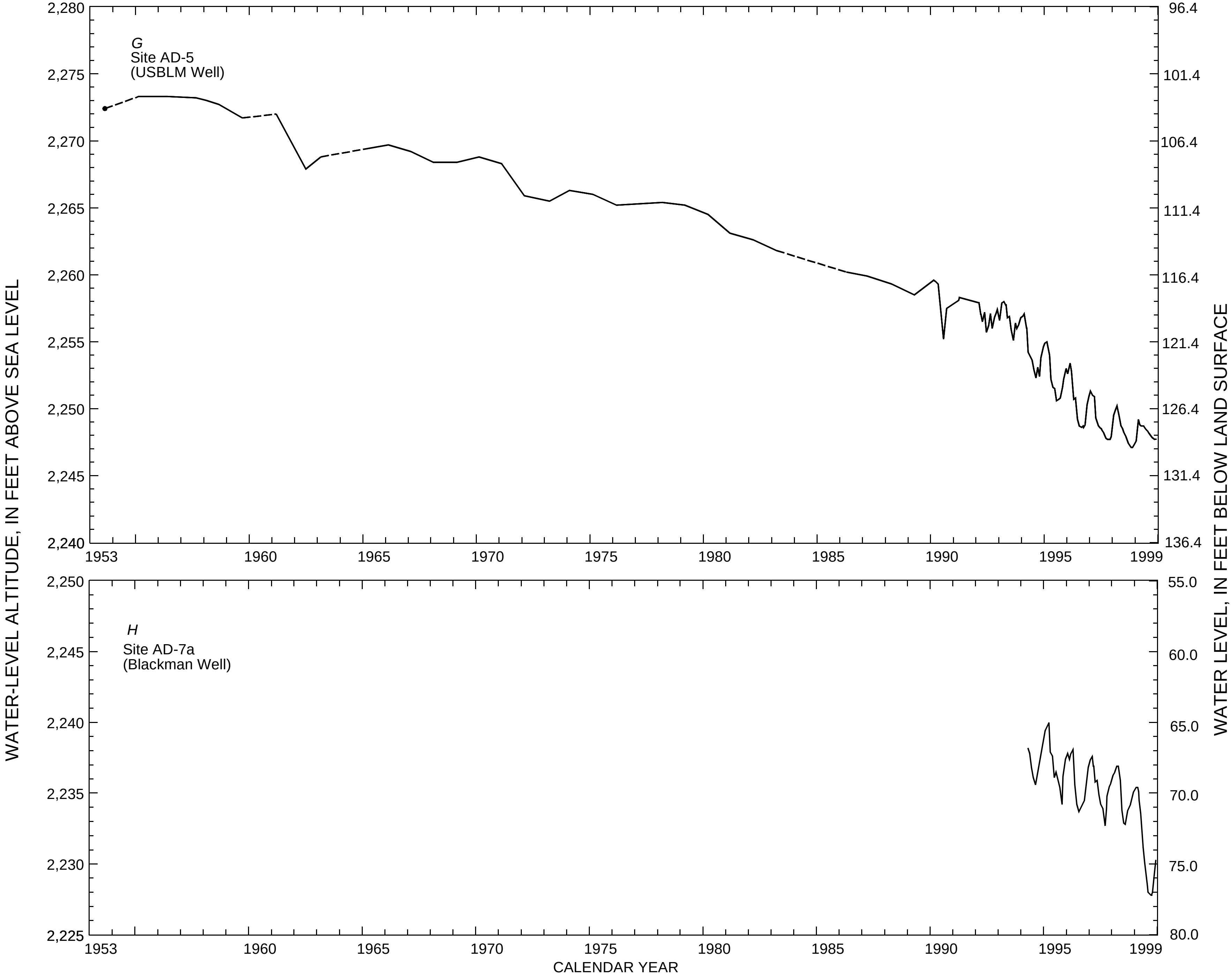

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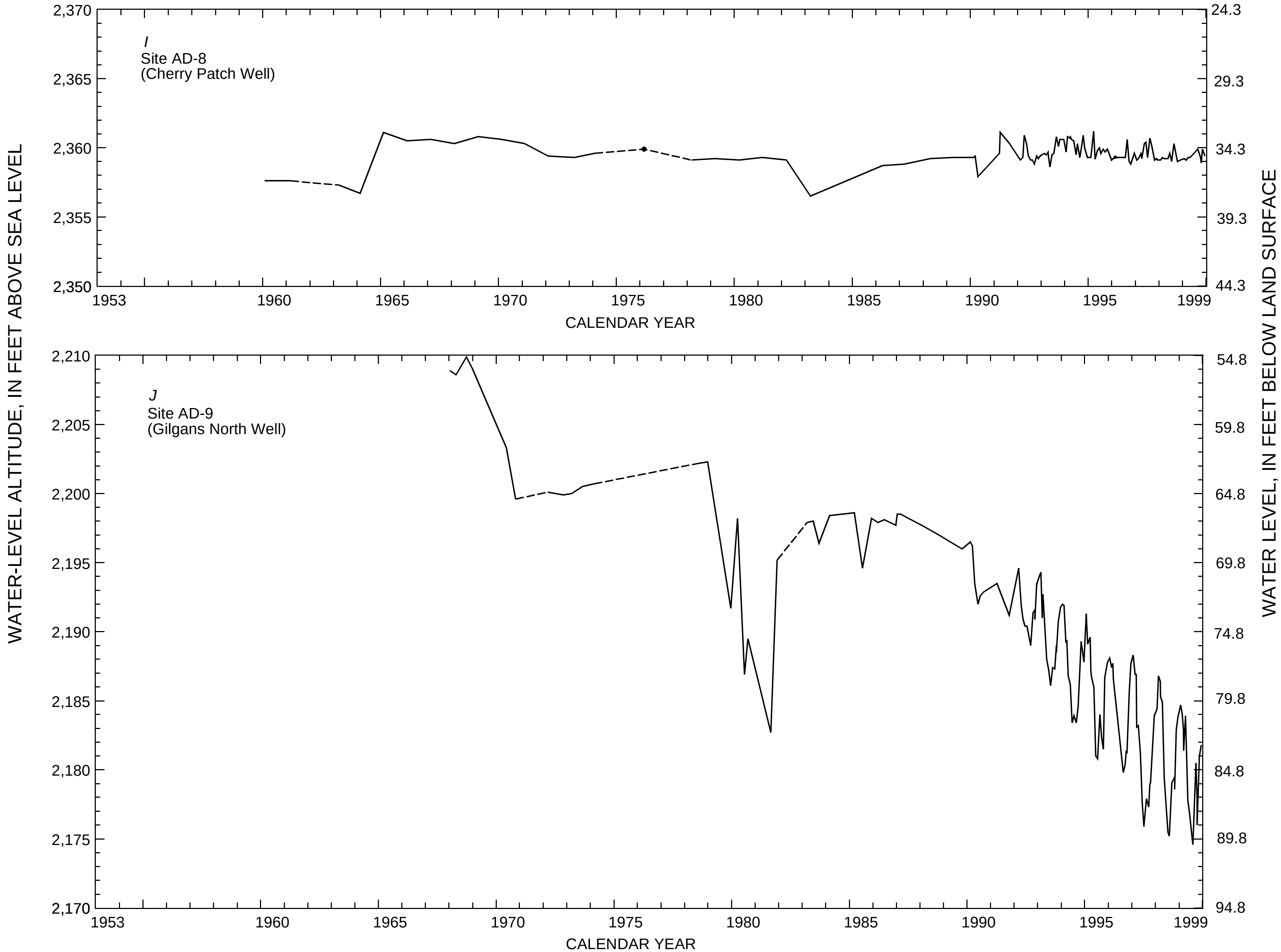

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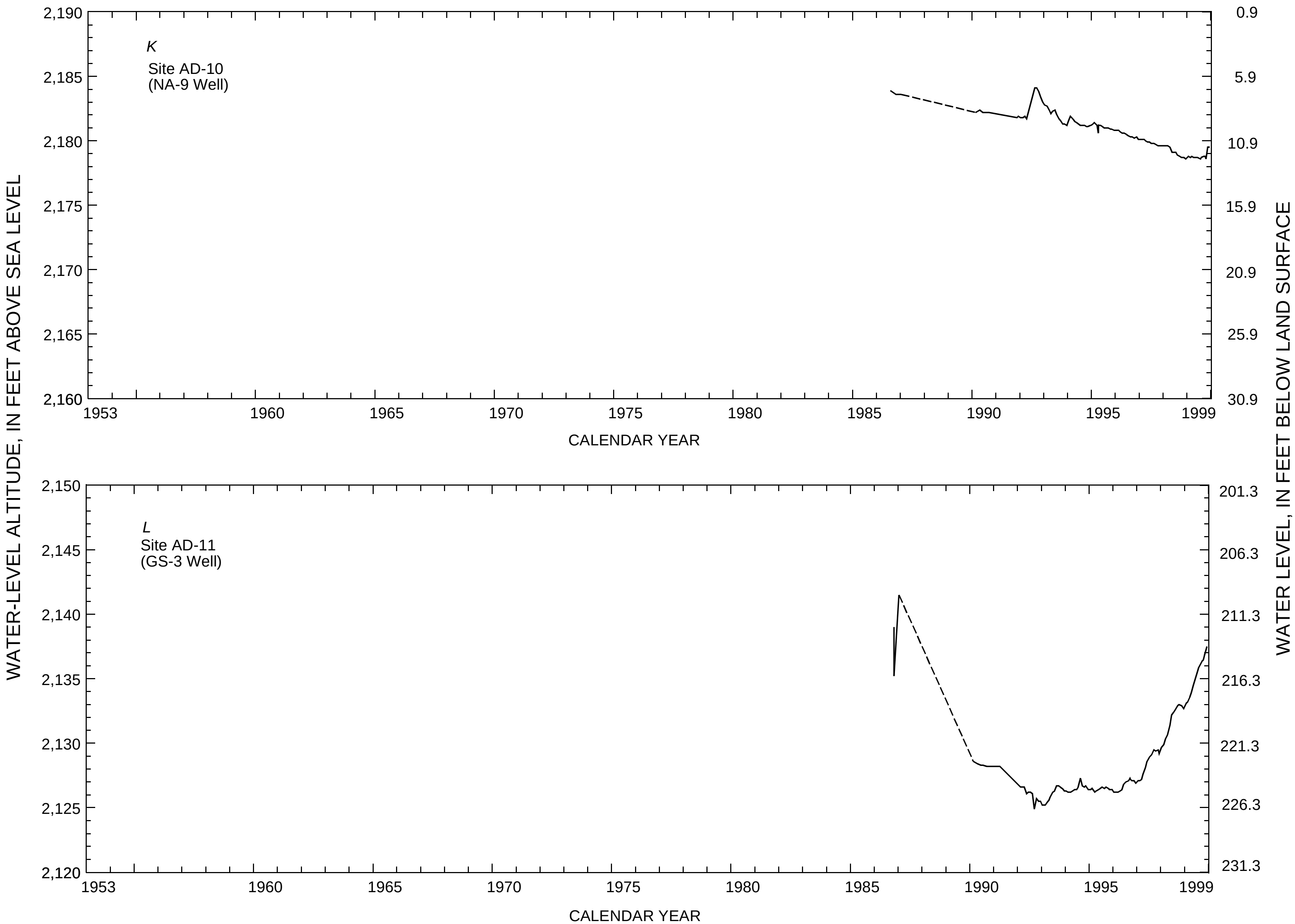

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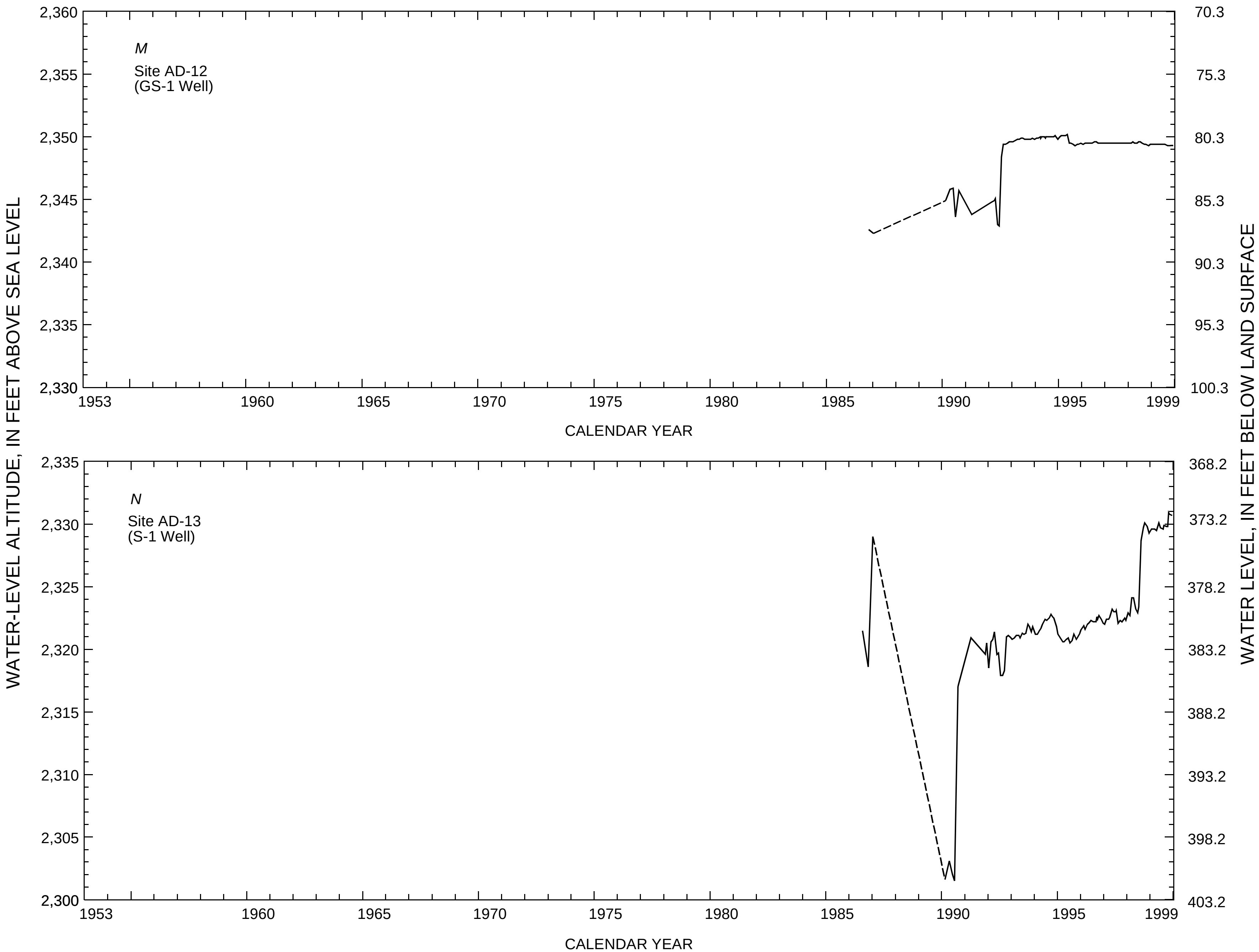

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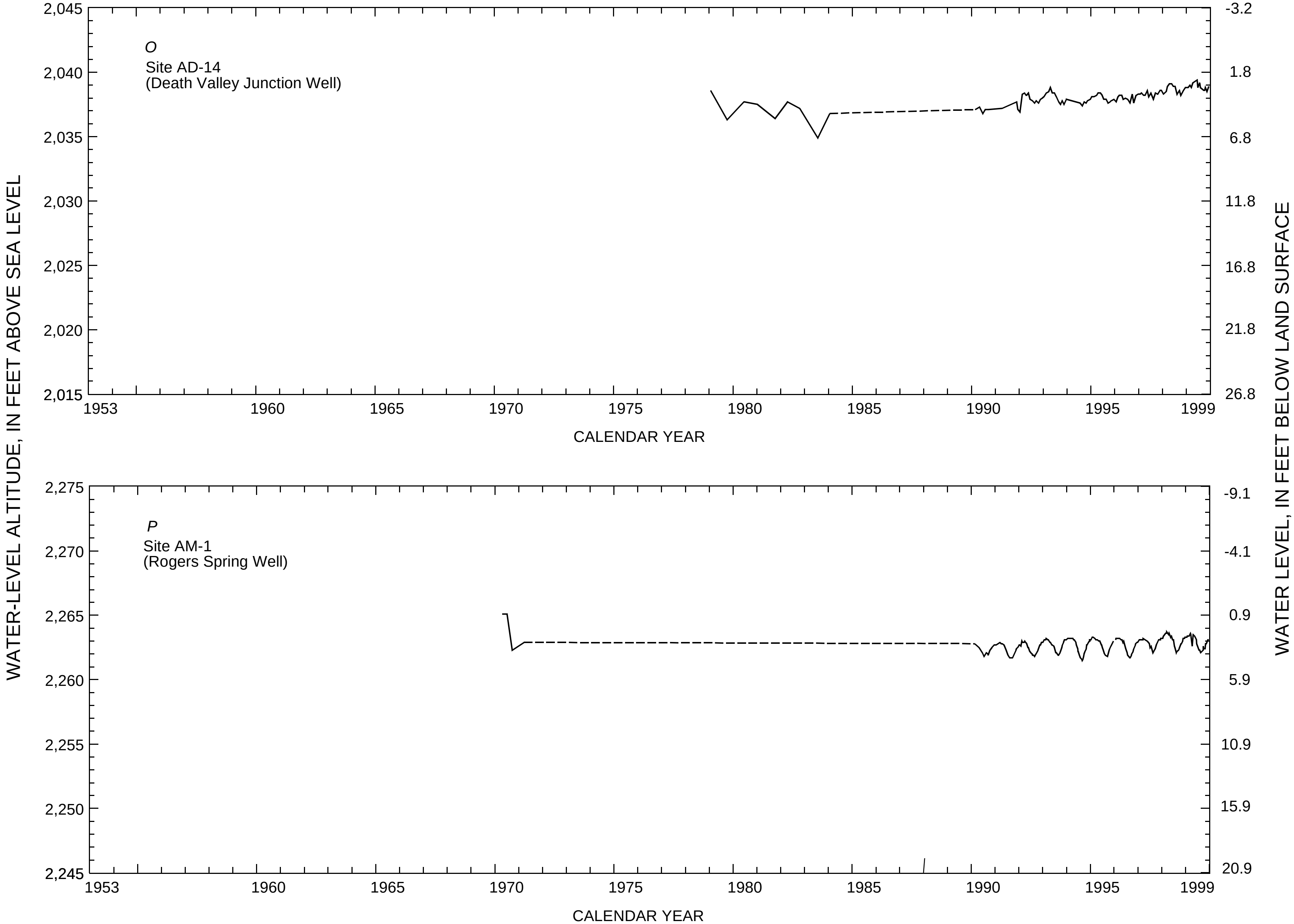

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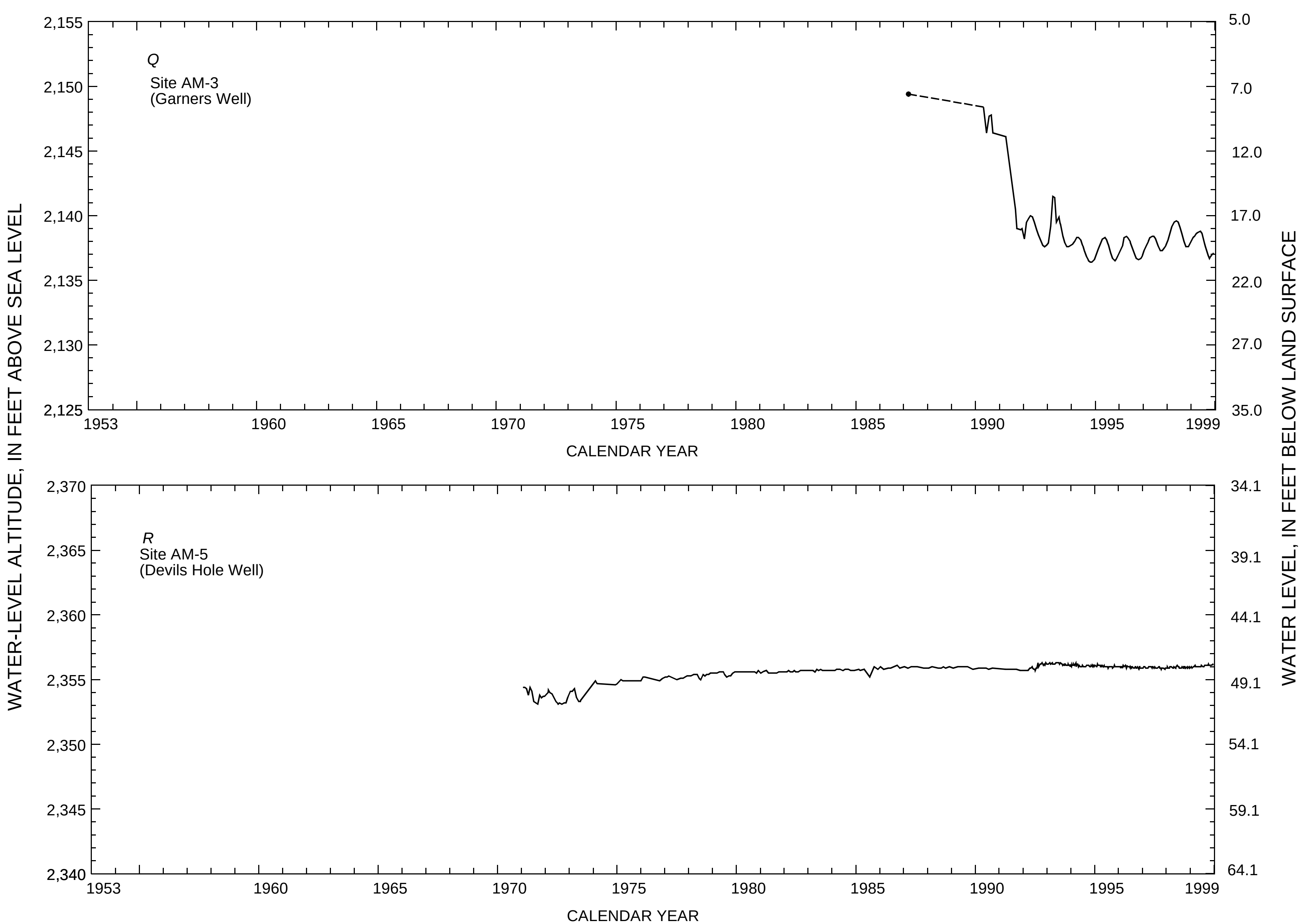

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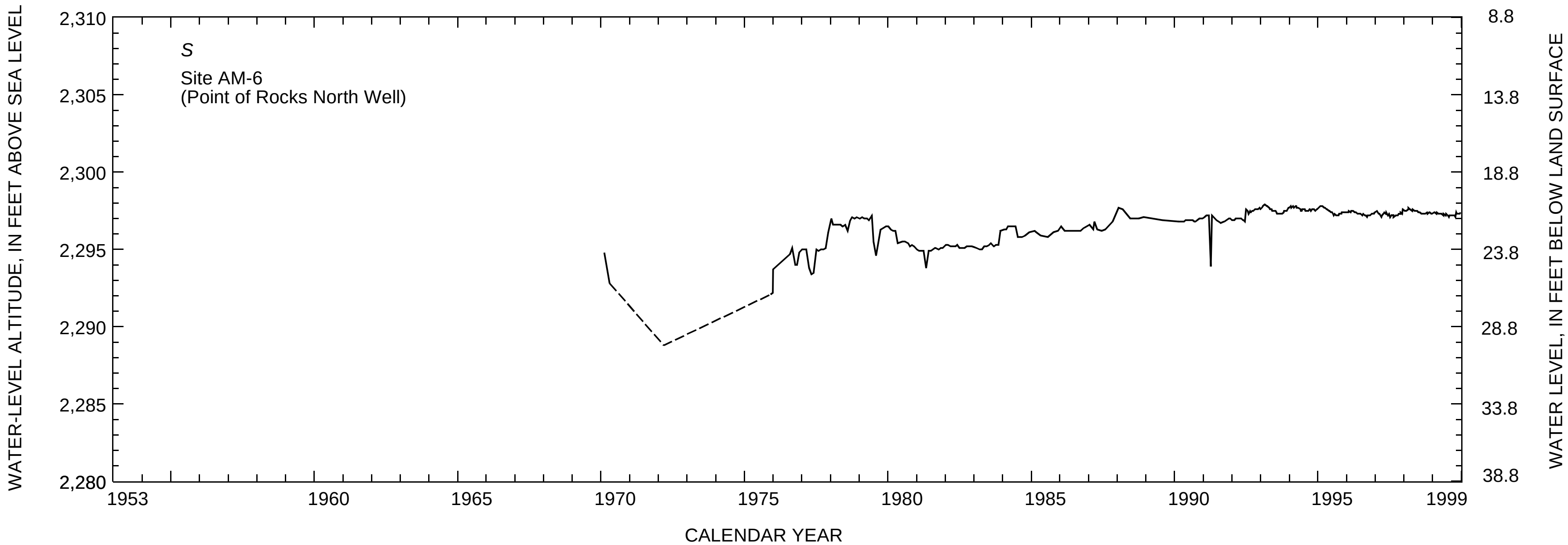

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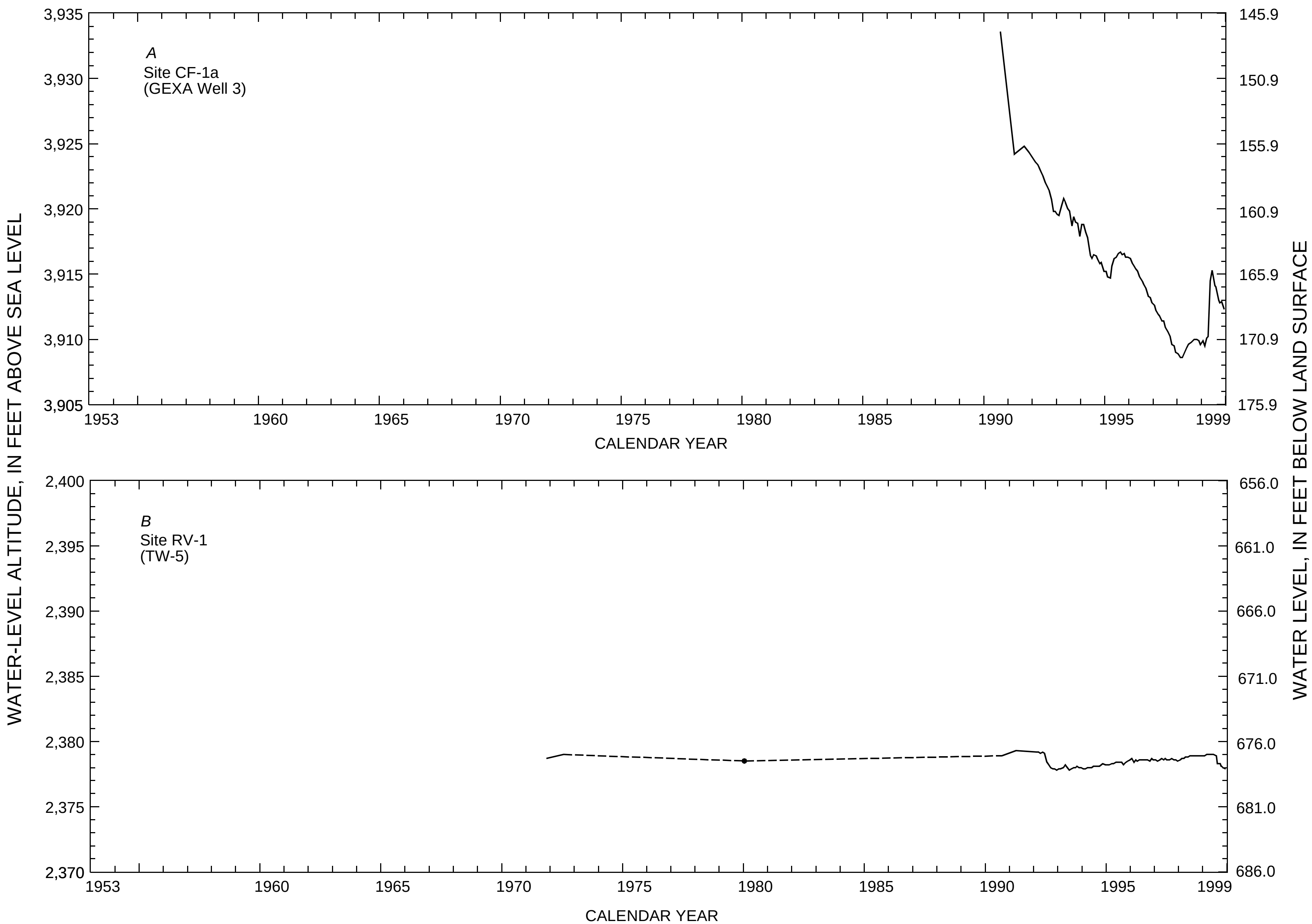


Figure 5. Periodic water levels through 1999 for selected sites at which primary contributing units are undifferentiated sedimentary rock. Lines connect periodic data presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Data that may represent short-term conditions at a site have been excluded (see section "Presentation of Ground-Water Data").

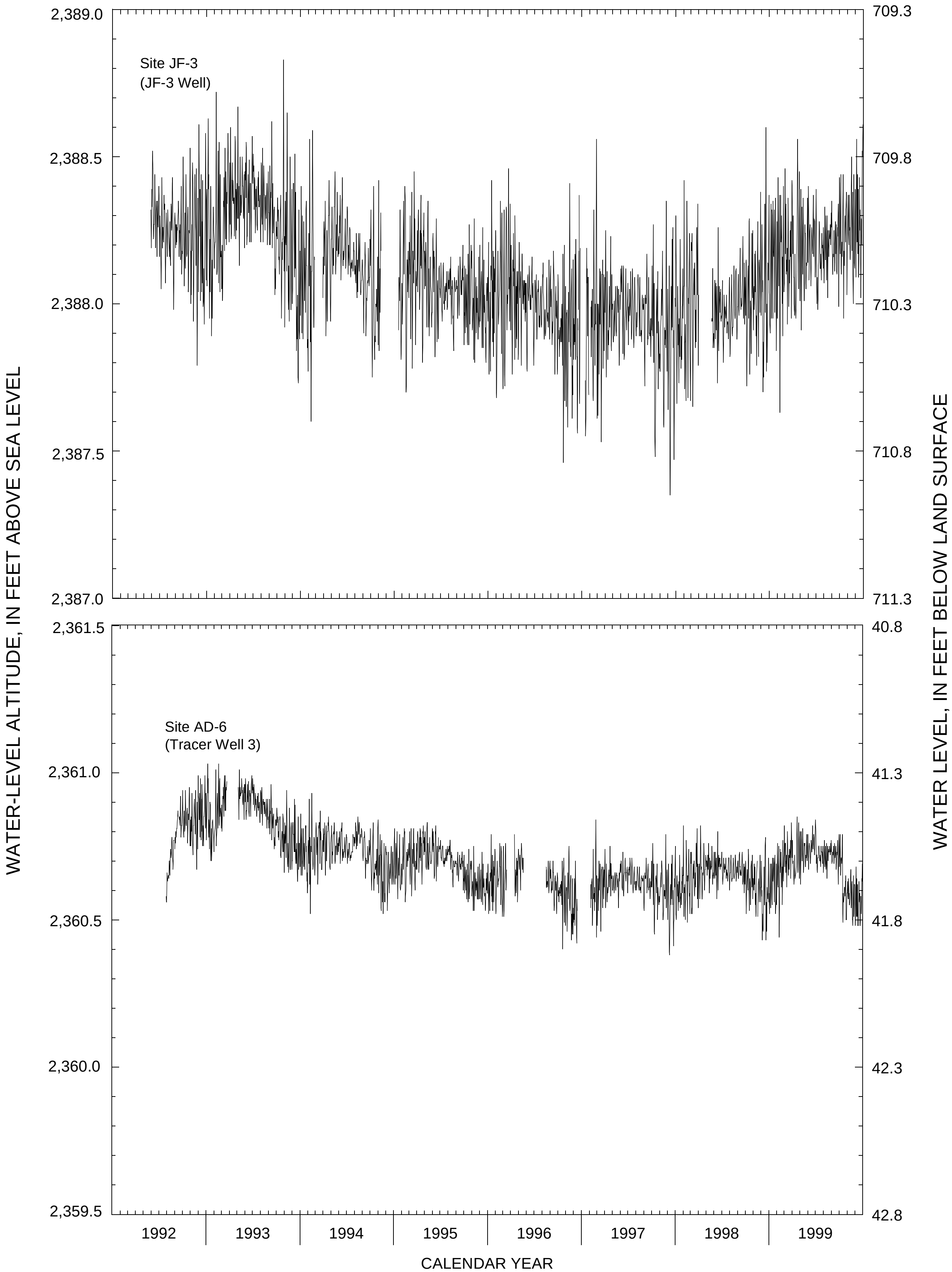


Figure 6
AD-6, July 1992 through December 1999

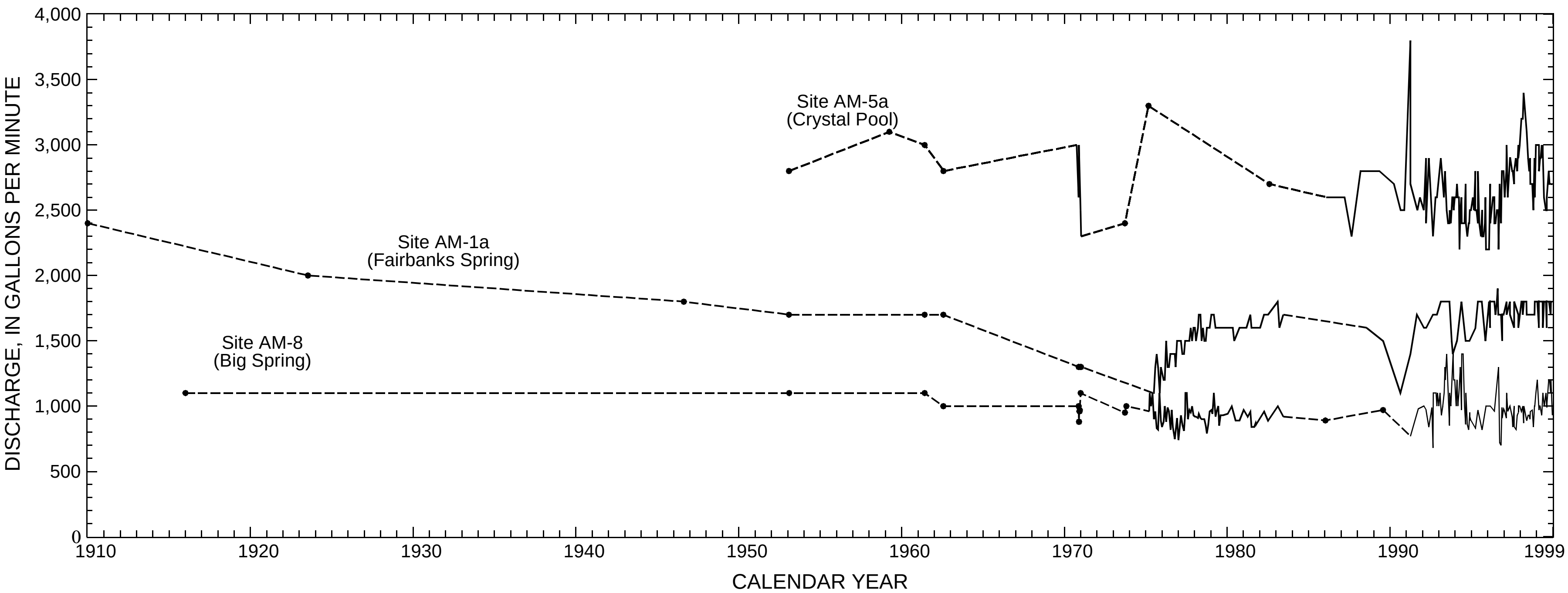


Figure 7. Discharge at sites AM-1a (Fairbanks Spring), AM-5a (Crystal Pool), and AM-8 (Big Spring) through 1999. Lines connect periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region. Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement.

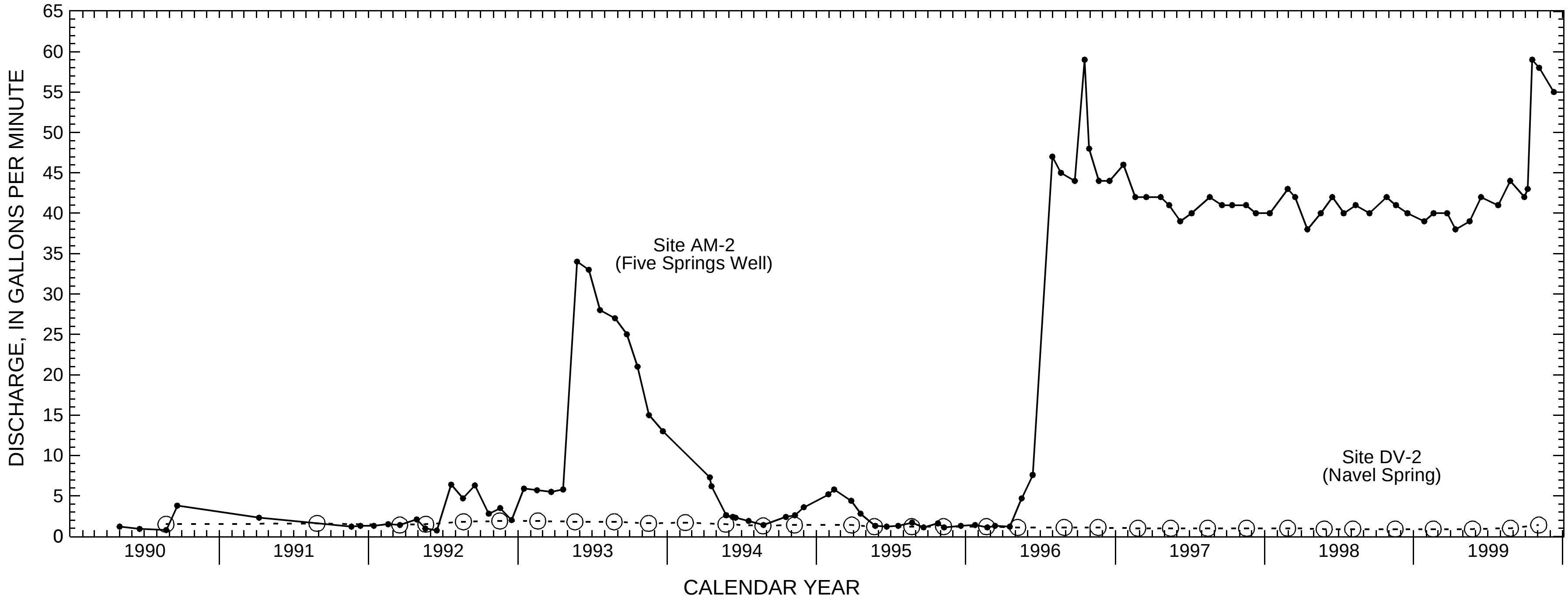


Figure 8. Discharge at sites AM-2 (Five Springs Well) and DV-2 (Navel Spring), 1990 through 1999. Symbols indicate periodic measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region.

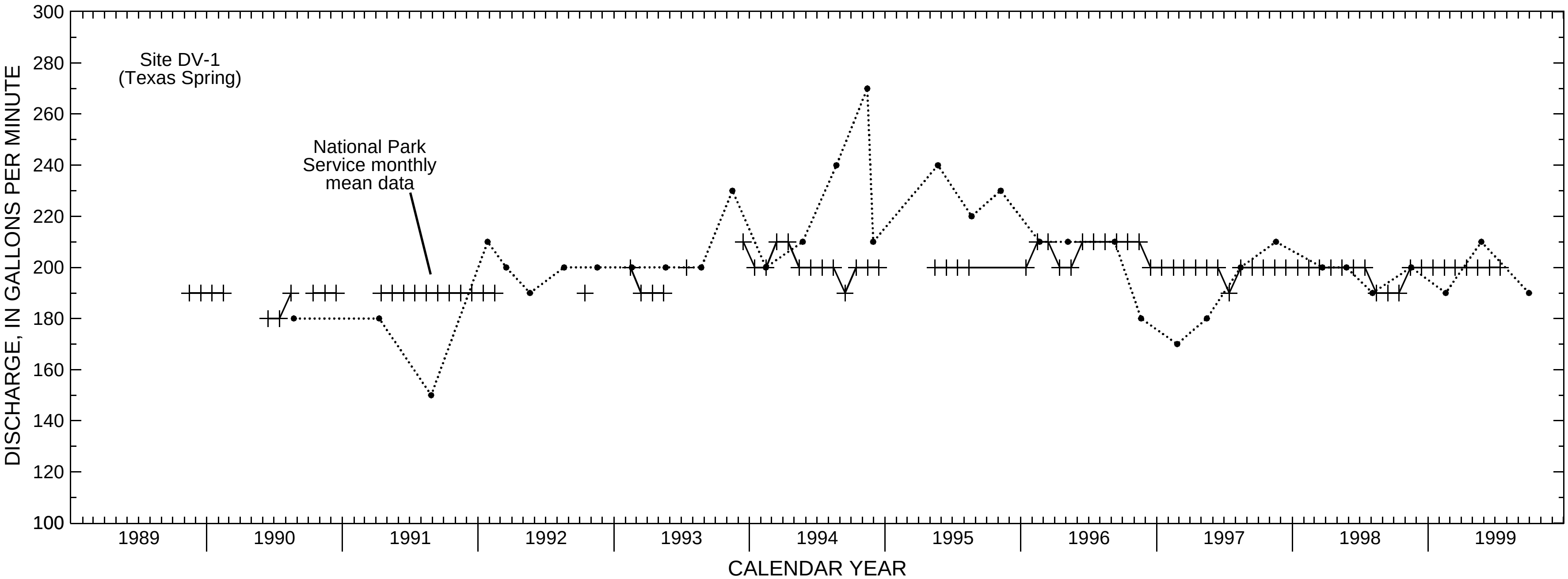


Figure 9. Discharge at site DV-1 (Texas Spring), 1989 through 1999. Dots indicate discrete USGS measurements presented in this and previous reports on selected ground-water data for Yucca Mountain region; periodic measurements for 1990–92 have been revised from those tabulated by La Camera and Westenburg (1994, table 5) to reflect water previously unaccounted for at the site. Plus symbols represent National Park Service monthly mean data for any given month and are not connected by a line where that data are not available for consecutive months. Differences between periodic measurements and monthly means may be due to site-specific conditions that affect accuracy of the measurement methods used. Accuracy of periodic measurements is limited by unmeasurable flow near the walls of the flume, an unequal distribution of velocities in the limited width of the measurement section, and a large percentage of total flow contained in each measurable portion of flow.

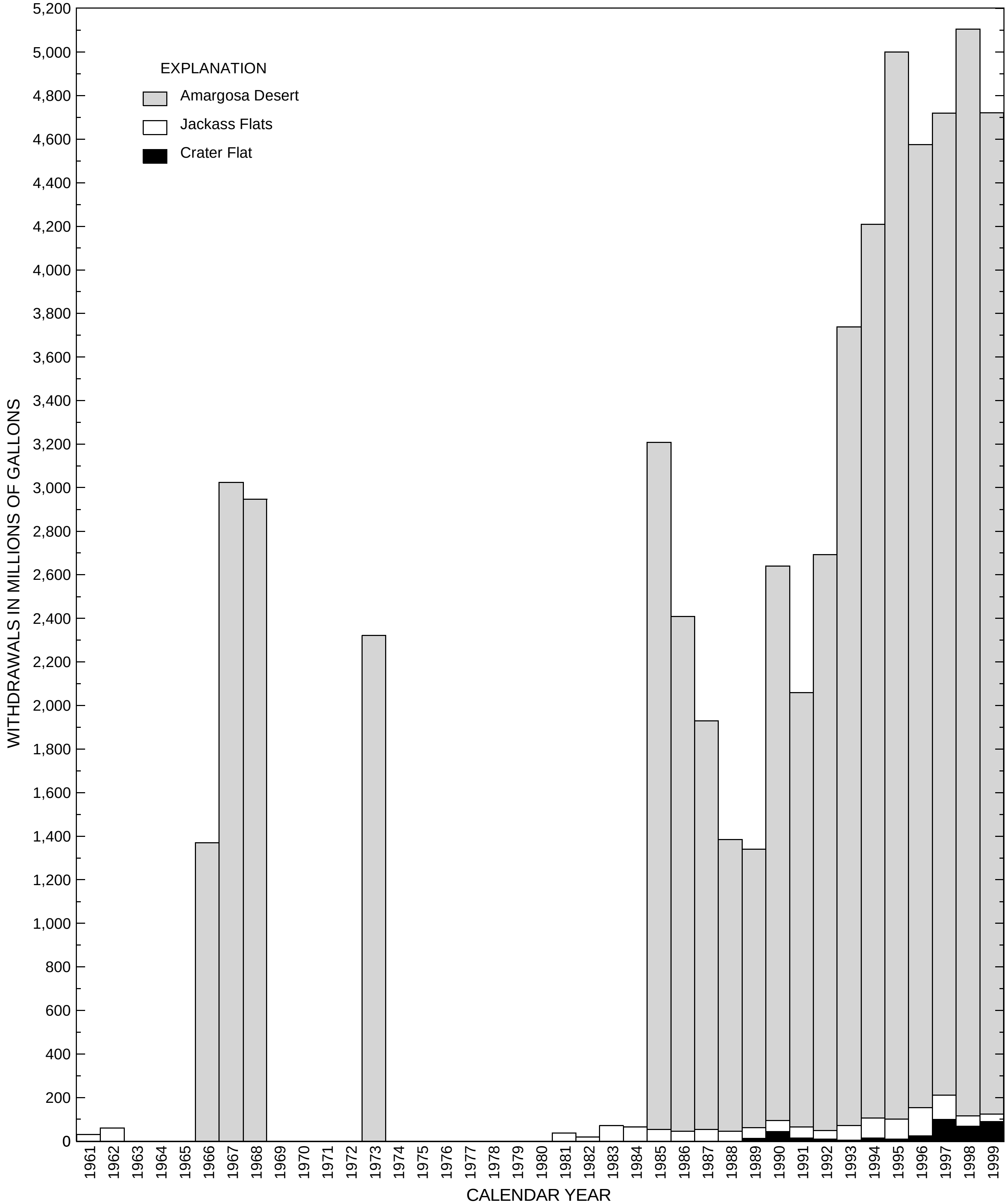


Figure 10. Available estimates of annual ground-water withdrawals for selected areas within Alkali Flat–Furnace Creek Ranch ground-water subbasin, 1961 through 1999.

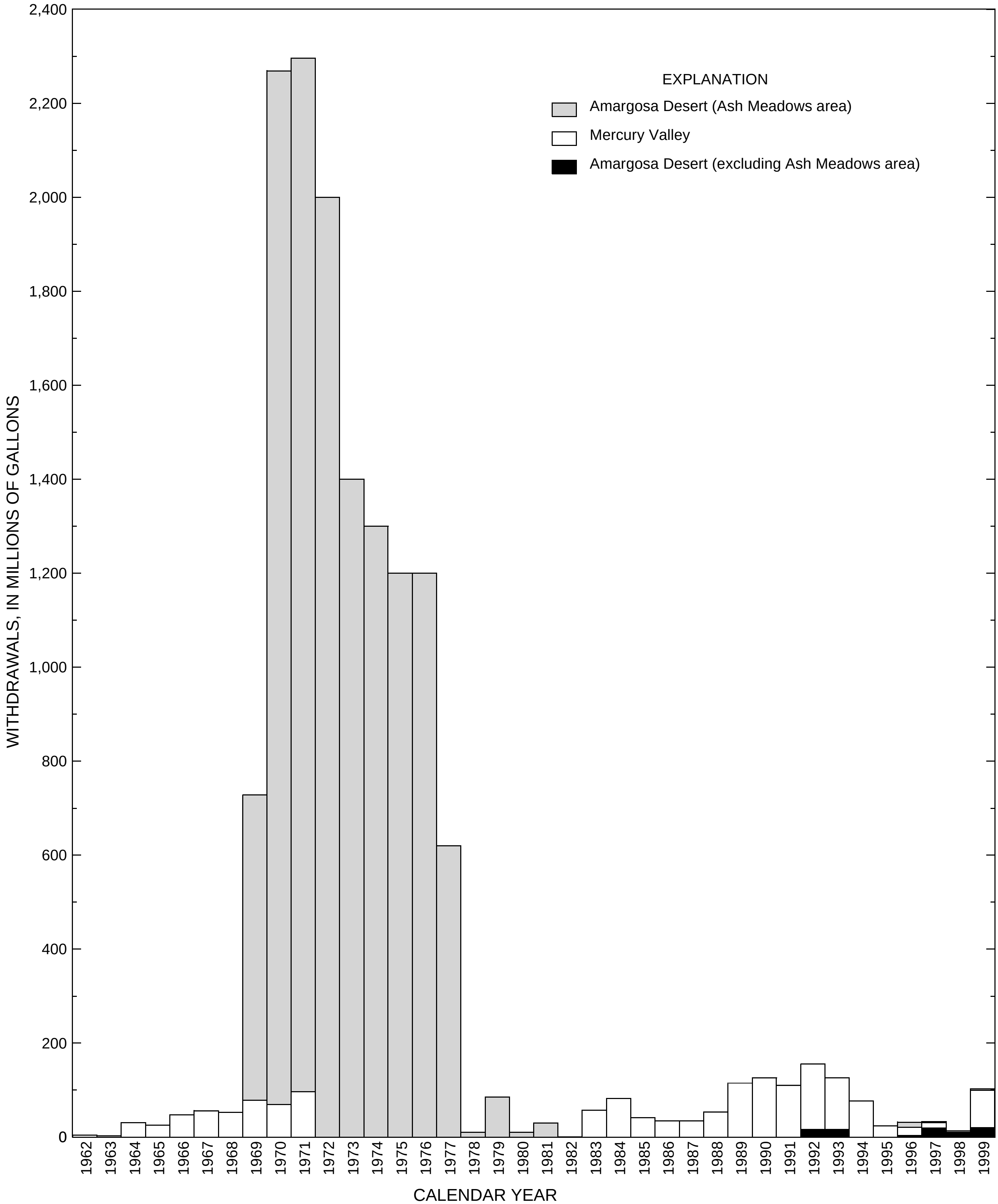


Figure 11. Available estimates of annual ground-water withdrawals for selected areas within Ash Meadows ground-water subbasin, 1962 through 1999.

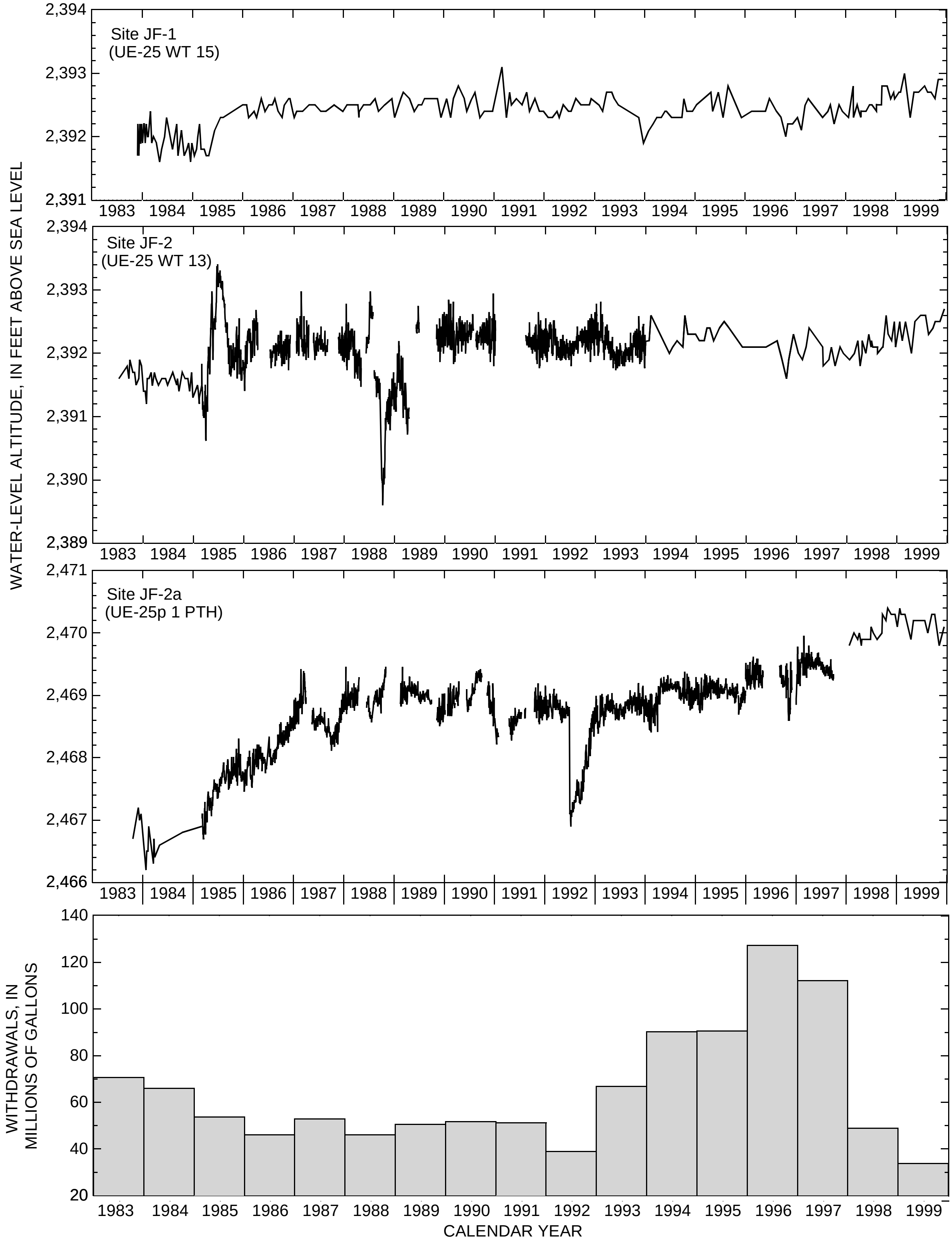
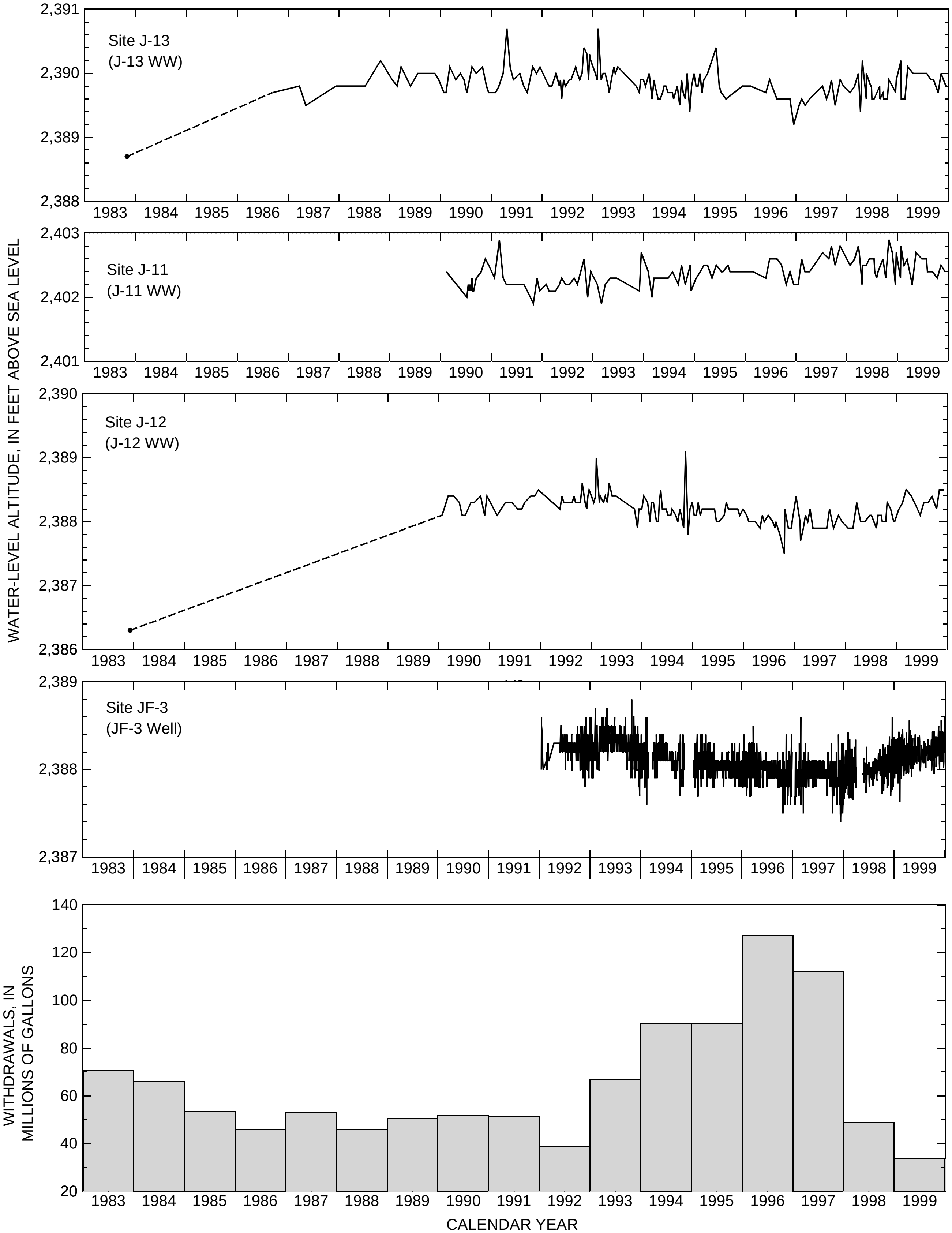


Figure 12. Water-level altitudes in wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3, and estimated annual ground-water withdrawals from Jackass Flats, 1983 through 1999. Lines connect periodic measurements or daily average water levels (when continual data recorded by instrumentation were available for more than half a year). Solid lines connect yearly or more frequent measurements. Lines are dashed where measurements were not available for consecutive calendar years. A solid dot is a single isolated measurement. Periodic measurements that may reflect short-term conditions at a site have been excluded (see section "Discussion of Ground-Water Levels and Ground-Water Withdrawals in Jackass Flats").



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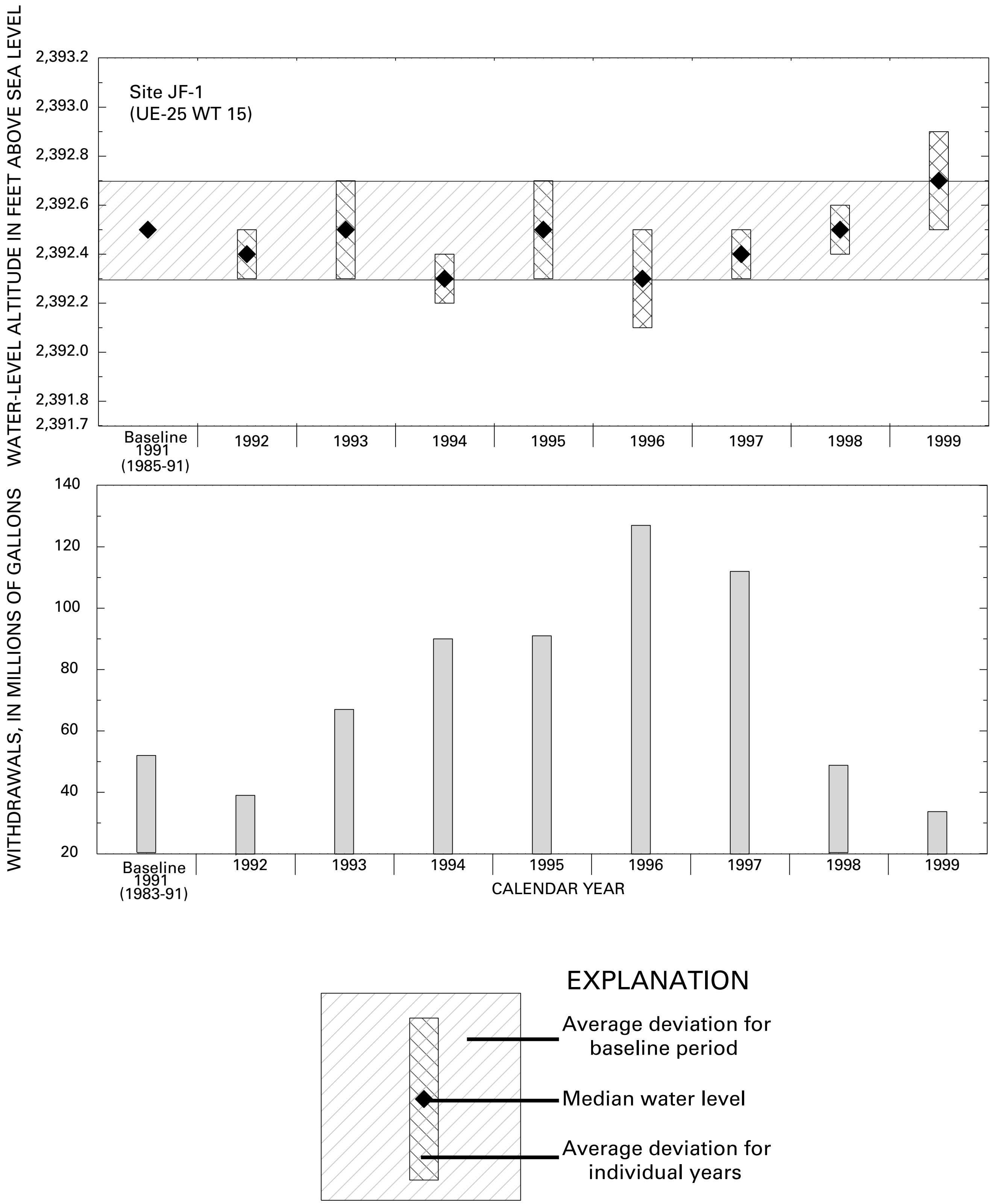
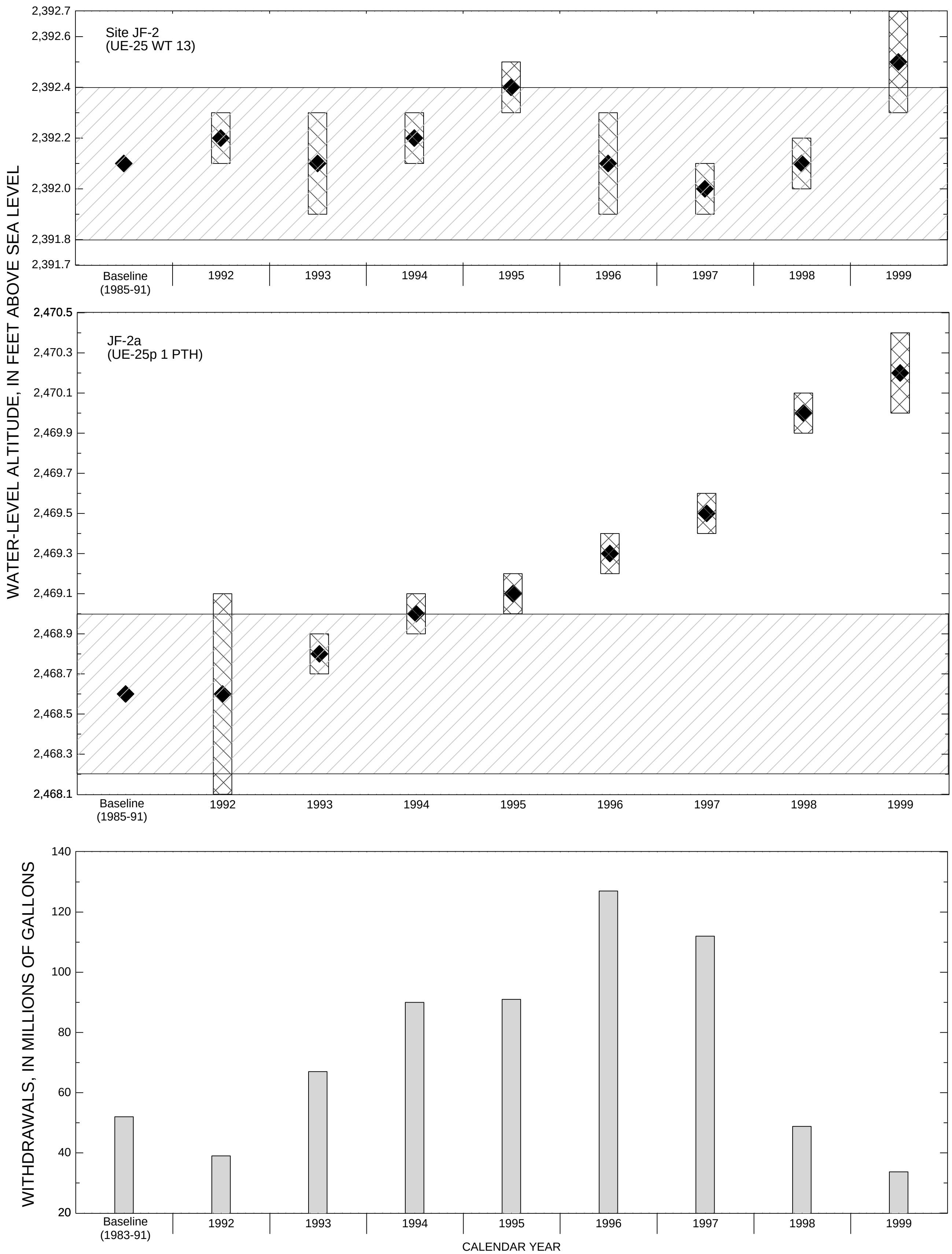


Figure 13. Median water-level altitudes and average deviation of water levels for wells JF-1, JF-2, JF-2a, J-13, J-11, J-12, and JF-3, and estimated annual ground-water withdrawals from Jackass Flats, for selected baseline periods and for calendar years 1992 through 1999. Statistical data for individual years included in baseline periods are not shown.



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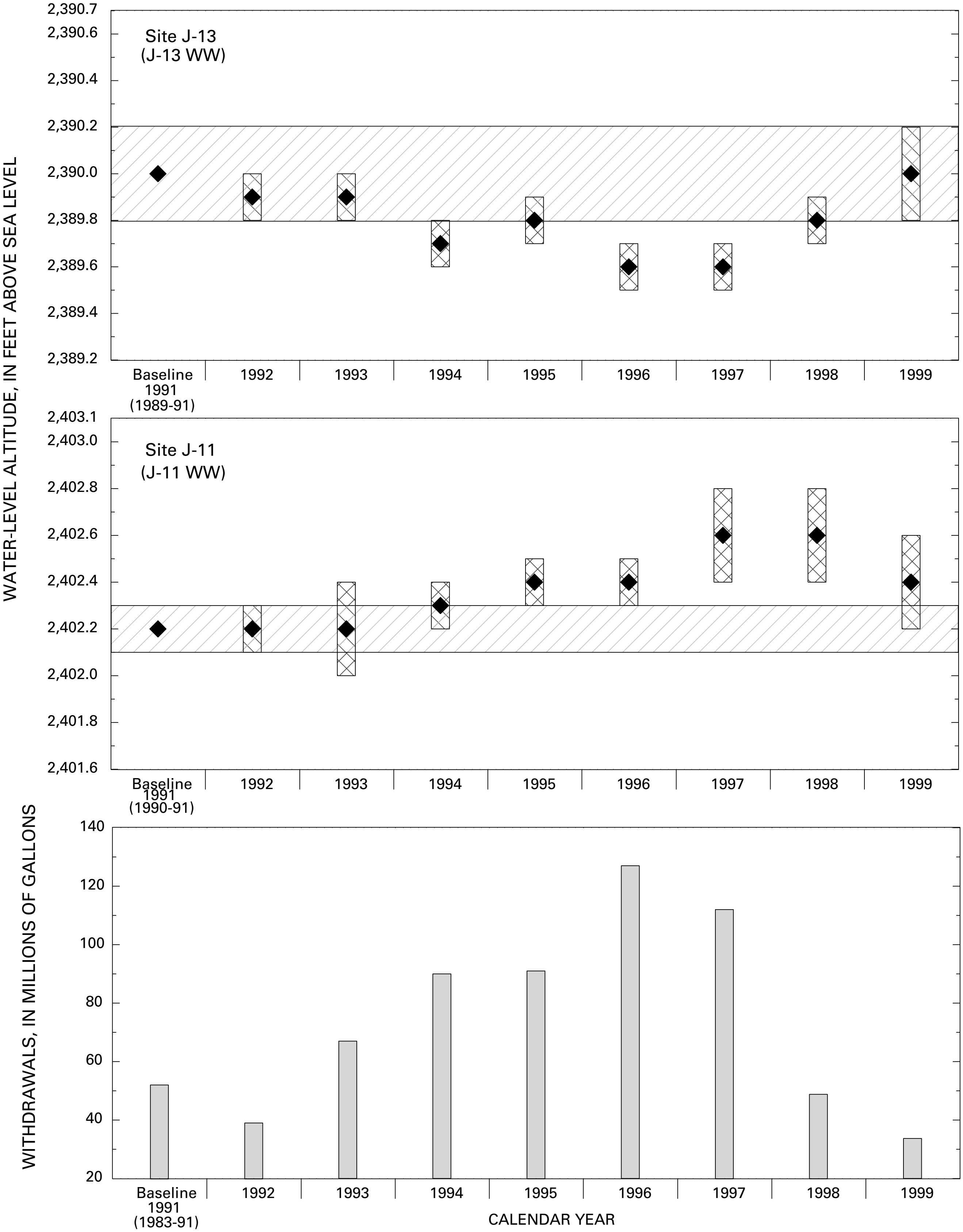

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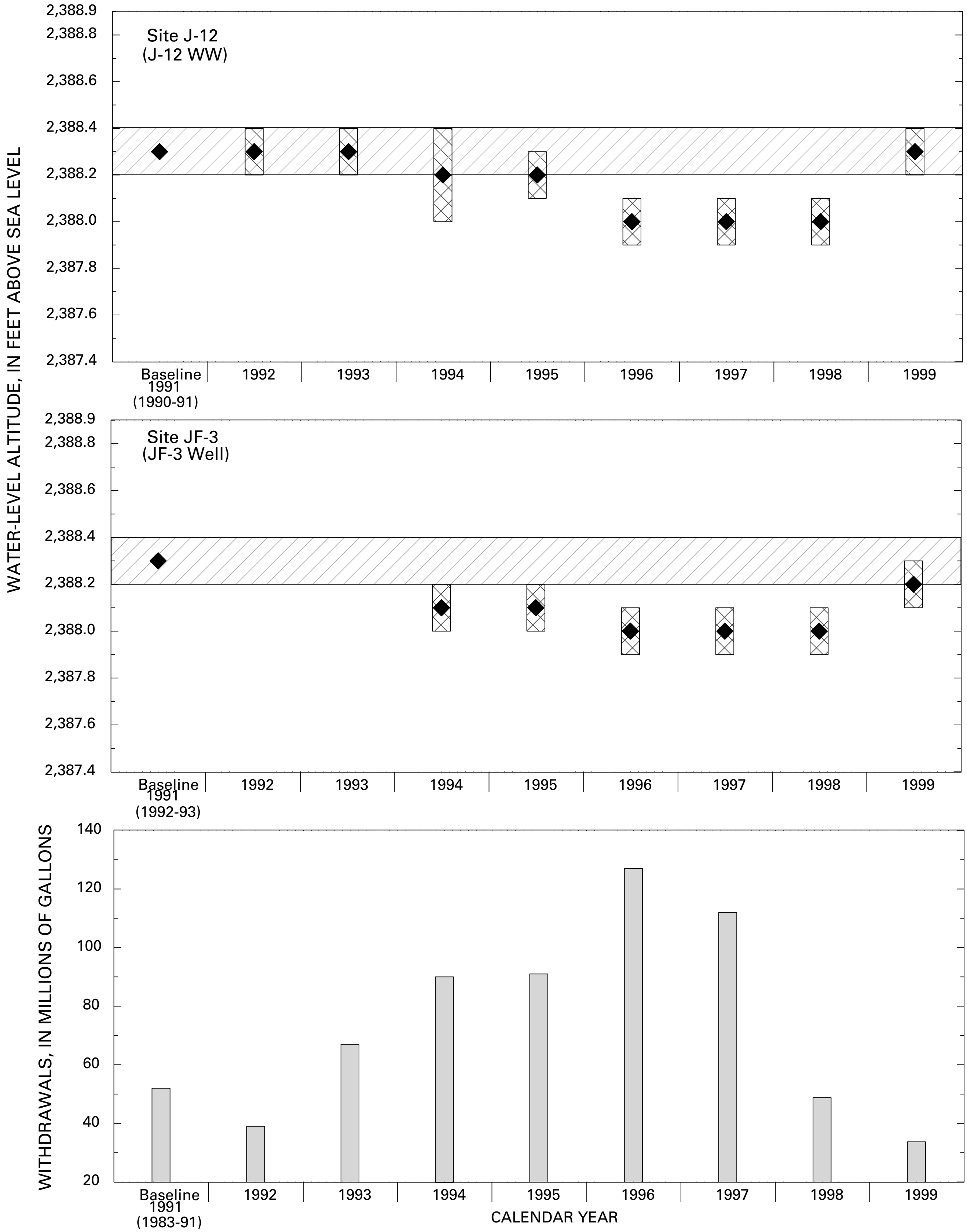

Figure 13. Continued.

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Land-surface altitude: Altitude of land surface in vicinity of site. Exception is altitude for site AM-4, which is altitude of bolt that serves as measurement point. Altitudes are reported to nearest 0.1 foot and were derived from USGS land surveys.

Height of measurement point: Height of measurement point (MP) most recently used. MP is stable, recoverable point from which periodic measurements to depth of water are made. MP at site AM-4 is bolt fastened to south wall of fissure, and is not referenced to land surface. Negative number indicates MP is below land surface.

Depth to water: Depths listed generally represent water level below land surface. An exception is site AM-4, where data represent water levels below measurement point. Apparent differences in depth to water at sites that list data from several sources may result from differing estimates of distance from land surface to measurement point used.

Method: Method used to measure depth to water. N, ruled tape; R, reported; S, steel tape; T, electric tape; V, calibrated electric tape.

Site status: Known conditions at site that may have affected measured depth to water. F, flowing; P, pumping; Z, measurement made in pump-discharge column.

Data source: EMP, Environmental-Monitoring Program (USGS); NDWR, Nevada Division of Water Resources; NPS, National Park Service; PVT, private owner; SCP, Site Characterization Project (USGS); USFWS, U.S. Fish & Wildlife Service; USGS-NV, other Nevada District programs.

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-1a	365445116383901	GEXA Well 3	4,080.9	1.68	01-26-1999	1142	170.95	3,910.0	S	—	EMP
					02-23-1999	0756	171.37	3,909.5	S	—	EMP
					03-24-1999	1046	170.80	3,910.1	S	—	EMP
					04-14-1999	0928	170.74	3,910.2	S	—	EMP
					05-19-1999	0925	166.36	3,914.5	S	—	EMP
					06-16-1999	0915	165.61	3,915.3	S	—	EMP
					07-27-1999	1820	166.81	3,914.1	S	—	EMP
					08-09-1999	1253	166.91	3,914.0	S	—	EMP
					09-24-1999	1337	167.86	3,913.0	S	—	EMP
					10-07-1999	0901	168.09	3,912.8	S	—	EMP
					11-04-1999	1443	168.03	3,912.9	S	—	EMP
					12-13-1999	1313	168.62	3,912.3	S	—	EMP
CF-2	364732116330701	USWVH-1	3,161.1	1.17	01-20-1999	0900	603.59	2,557.5	S	—	SCP
					02-02-1999	1426	603.67	2,557.4	S	—	SCP
					03-09-1999	1412	603.60	2,557.5	S	—	SCP
					04-19-1999	1410	603.58	2,557.5	S	—	SCP
					05-03-1999	1342	603.47	2,557.6	S	—	SCP
					06-21-1999	1430	603.50	2,557.6	S	—	SCP
					07-27-1999	1148	603.68	2,557.4	S	—	SCP
					08-17-1999	0853	603.76	2,557.3	S	—	SCP
					09-16-1999	1008	603.68	2,557.4	S	—	SCP
					10-19-1999	0906	603.74	2,557.4	S	—	SCP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
CF-2	364732116330701	USWVH-1	3,161.1	1.17	11-16-1999	1012	603.61	2,557.5	S	—	SCP
					12-15-1999	0958	603.85	2,557.2	S	—	SCP
CF-3	364105116302601	Cind-R-Lite Well	2,725.6	-3.20	01-26-1999	1348	331.42	2,394.2	S	—	EMP
					02-25-1999	0855	331.55	2,394.0	S	—	EMP
					03-24-1999	1250	331.46	2,394.1	S	—	EMP
					04-14-1999	1115	331.52	2,394.1	S	—	EMP
					05-19-1999	1110	331.55	2,394.0	S	—	EMP
					06-16-1999	1125	331.50	2,394.1	S	—	EMP
					07-28-1999	1120	331.41	2,394.2	S	—	EMP
					08-09-1999	1138	331.33	2,394.3	S	—	EMP
					09-24-1999	1106	331.41	2,394.2	S	—	EMP
					10-07-1999	1142	331.50	2,394.1	S	—	EMP
					11-04-1999	1331	331.33	2,394.3	S	—	EMP
					12-13-1999	1219	331.32	2,394.3	S	—	EMP
JF-1	365116116233801	UE-25 WT 15	3,553.8	0.18	01-21-1999	1238	1,161.13	2,392.7	S	—	SCP
					02-03-1999	1410	1,161.11	2,392.7	S	—	SCP
					03-03-1999	1326	1,160.84	2,393.0	S	—	SCP
					04-15-1999	1254	1,161.46	2,392.3	S	—	SCP
					05-12-1999	1259	1,161.07	2,392.7	S	—	SCP
					06-15-1999	0821	1,161.14	2,392.7	S	—	SCP
					07-28-1999	1551	1,161.03	2,392.8	S	—	SCP
					08-19-1999	1032	1,161.14	2,392.7	S	—	SCP
					09-13-1999	1142	1,161.13	2,392.7	S	—	SCP
					10-12-1999	1321	1,161.22	2,392.6	S	—	SCP
					11-04-1999	1510	1,160.95	2,392.8	S	—	SCP
					12-09-1999	1535	1,160.90	2,392.9	S	—	SCP
JF-2	364945116235001	UE-25 WT 13	3,387.5	1.00	01-21-1999	1314	995.03	2,392.5	S	—	SCP
					01-25-1999	0816	995.05	2,392.4	S	—	SCP
					02-10-1999	1506	995.27	2,392.2	S	—	SCP
					03-05-1999	1536	995.01	2,392.5	S	—	SCP
					04-16-1999	1516	995.48	2,392.0	S	—	SCP
					05-12-1999	1407	994.97	2,392.5	S	—	SCP
					06-22-1999	1230	994.89	2,392.6	S	—	SCP
					07-29-1999	1042	994.94	2,392.6	S	—	SCP
					08-19-1999	1138	995.17	2,392.3	S	—	SCP
					09-20-1999	1146	995.15	2,392.4	S	—	SCP

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
JF-2	364945116235001	UE-25 WT 13	3,387.5	1.00	10-07-1999	1213	995.02	2,392.5	S	—	SCP
					11-10-1999	1108	995.00	2,392.5	S	—	SCP
					12-13-1999	1426	994.76	2,392.7	S	—	SCP
JF-2a	364938116252102	UE-25p 1 PTH	3,655.5	0.56	01-07-1999	1514	1,185.37	2,470.1	S	—	SCP
					01-25-1999	0952	1,185.13	2,470.4	V	—	EMP
					02-04-1999	1059	1,185.24	2,470.3	S	—	SCP
					03-03-1999	1423	1,185.21	2,470.3	S	—	SCP
					04-15-1999	1346	1,185.61	2,469.9	S	—	SCP
					05-04-1999	1149	1,185.25	2,470.2	S	—	SCP
					06-17-1999	1157	1,185.29	2,470.2	S	—	SCP
					07-26-1999	1407	1,185.28	2,470.2	S	—	SCP
					08-16-1999	1552	1,185.49	2,470.0	S	—	SCP
					09-15-1999	0948	1,185.19	2,470.3	S	—	SCP
					10-06-1999	1102	1,185.16	2,470.3	S	—	SCP
					11-08-1999	1254	1,185.68	2,469.8	S	—	SCP
					12-13-1999	1243	1,185.35	2,470.2	S	—	SCP
J-13	364828116234001	J-13 WW	3,317.9	1.11	01-25-1999	0916	927.68	2,390.2	V	—	EMP
					01-27-1999	0922	928.28	2,389.6	S	—	SCP
					02-22-1999	0844	928.33	2,389.6	S	—	SCP
					03-15-1999	1253	927.75	2,390.2	S	—	SCP
					04-20-1999	0916	927.89	2,390.0	S	—	SCP
					05-13-1999	1520	927.88	2,390.0	S	—	SCP
					06-21-1999	0738	927.89	2,390.0	S	—	SCP
					07-29-1999	0836	927.91	2,390.0	S	—	SCP
					08-26-1999	1612	928.01	2,389.9	S	—	SCP
					09-16-1999	0748	928.00	2,389.9	S	—	SCP
					10-20-1999	0808	928.16	2,389.7	S	—	SCP
					11-10-1999	0852	927.86	2,390.0	S	—	SCP
					12-15-1999	0846	928.12	2,389.8	S	—	SCP
J-11	364706116170601	J-11 WW	3,442.8	2.11	01-22-1999	0928	1,040.48	2,402.3	S	—	SCP
					01-25-1999	1045	1,039.96	2,402.8	V	—	EMP
					02-17-1999	0849	1,040.35	2,402.4	S	—	SCP
					03-10-1999	1552	1,040.21	2,402.6	S	—	SCP
					04-16-1999	1604	1,040.55	2,402.2	S	—	SCP
					05-13-1999	1428	1,040.10	2,402.7	S	—	SCP
					06-24-1999	1522	1,040.23	2,402.6	S	—	SCP
					07-28-1999	1324	1,040.25	2,402.6	S	—	SCP
					08-04-1999	0904	1,040.37	2,402.4	S	—	SCP
					09-07-1999	1014	1,040.40	2,402.4	S	—	SCP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
J-11	364706116170601	J-11 WW	3,442.8	2.11	10-13-1999	0852	1,040.47	2,402.3	S	—	SCP
					10-13-1999	1041	1,040.47	2,402.3	S	—	SCP
					11-10-1999	1150	1,040.33	2,402.5	S	—	SCP
					12-08-1999	1416	1,040.43	2,402.4	S	—	SCP
J-12	364554116232401	J-12 WW	3,128.4	3.95	01-21-1999	0915	740.22	2,388.2	S	—	SCP
					02-18-1999	1150	740.08	2,388.3	S	—	SCP
					03-15-1999	1156	739.88	2,388.5	S	—	SCP
					04-20-1999	1000	740.02	2,388.4	S	—	SCP
					05-13-1999	0924	740.06	2,388.3	S	—	SCP
					06-23-1999	1043	740.27	2,388.1	S	—	SCP
					07-21-1999	1544	740.14	2,388.3	S	—	SCP
					08-19-1999	0742	740.13	2,388.3	S	—	SCP
					09-15-1999	1544	740.04	2,388.4	S	—	SCP
					10-20-1999	1258	740.21	2,388.2	S	—	SCP
					11-08-1999	1514	739.89	2,388.5	S	—	SCP
					12-13-1999	1058	739.89	2,388.5	S	—	SCP
JF-3	364528116232201	JF-3 Well	3,098.3	2.27	01-25-1999	1146	709.91	2,388.4	V	—	EMP
					02-03-1999	0831	710.17	2,388.1	V	—	EMP
					03-03-1999	0902	709.93	2,388.4	V	—	EMP
					04-06-1999	0903	710.21	2,388.1	V	—	EMP
					05-03-1999	1046	709.98	2,388.3	V	—	EMP
					06-01-1999	1115	710.11	2,388.2	V	—	EMP
					07-07-1999	0846	710.28	2,388.0	V	—	EMP
					08-03-1999	0846	710.26	2,388.0	V	—	EMP
					09-01-1999	0916	709.99	2,388.3	V	—	EMP
					10-05-1999	0900	710.08	2,388.2	V	—	EMP
					11-01-1999	0946	710.10	2,388.2	V	—	EMP
					12-14-1999	0846	710.25	2,388.0	V	—	EMP
RV-1	363815116175901	TW-5	3056.0	1.6	01-26-1999	1445	677.09	2,378.9	V	—	EMP
					02-25-1999	1050	677.03	2,379.0	V	—	EMP
					03-24-1999	1418	677.00	2,379.0	V	—	EMP
					04-12-1999	1257	677.04	2,379.0	V	—	EMP
					05-19-1999	0725	676.99	2,379.0	V	—	EMP
					06-15-1999	1258	676.97	2,379.0	V	—	EMP
					07-28-1999	1001	677.06	2,378.9	V	—	EMP
					08-09-1999	0946	677.72	2,378.3	V	—	EMP
					09-24-1999	1507	677.74	2,378.3	V	—	EMP
					10-07-1999	0710	677.88	2,378.1	V	—	EMP

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
RV-1	363815116175901	TW-5	3056.0	1.6	10-16-1999	1523	677.92	2,378.1	V	—	EMP
					11-04-1999	1700	678.04	2,378.0	V	—	EMP
					12-14-1999	1202	678.08	2,377.9	V	—	EMP
MV-1	363530116021401	Army 1 WW	3153.3	3.10	01-28-1999	0850	785.33	2,368.0	V	Z	EMP
					02-25-1999	0805	784.74	2,368.6	V	Z	EMP
					03-25-1999	0827	784.95	2,368.4	V	Z	EMP
					04-27-1999	1009	784.90	2,368.4	V	Z	EMP
					05-20-1999	0745	785.09	2,368.2	V	Z	EMP
					06-17-1999	0750	785.04	2,368.3	V	Z	EMP
					07-28-1999	0902	785.11	2,368.2	V	Z	EMP
					08-09-1999	0823	785.03	2,368.3	V	Z	EMP
					09-27-1999	0802	784.97	2,368.3	V	Z	EMP
					10-19-1999	0738	785.24	2,368.1	V	Z	EMP
					11-04-1999	0735	784.95	2,368.4	V	Z	EMP
					12-14-1999	0740	785.28	2,368.0	V	Z	EMP
AD-1	364141116351401	USGS Well NA-6 BGMW-10	2627.9	1.7	01-26-1999	1253	269.68	2,358.2	S	—	EMP
					02-16-1999	—	269.8	2,358.1	R	—	PVT
					02-23-1999	0920	269.62	2,358.3	S	—	EMP
					03-24-1999	1205	269.62	2,358.3	S	—	EMP
					04-14-1999	1027	269.75	2,358.2	S	—	EMP
					05-18-1999	—	269.8	2,358.1	R	—	PVT
					05-19-1999	1020	269.35	2,358.6	S	—	EMP
					06-16-1999	1018	269.60	2,358.3	S	—	EMP
					07-27-1999	1929	269.52	2,358.4	S	—	EMP
					08-09-1999	1417	269.53	2,358.4	S	—	EMP
					09-24-1999	1153	269.67	2,358.2	S	—	EMP
					09-28-1999	—	269.80	2,358.1	R	—	PVT
					10-07-1999	1015	269.88	2,358.0	S	—	EMP
					11-04-1999	1532	269.50	2,358.4	S	—	EMP
					11-26-1999	1237	269.63	2,358.3	V	—	USGS-NV
					12-03-1999	—	269.90	2,358.0	R	—	PVT
					12-13-1999	1422	269.47	2,358.4	S	—	EMP
AD-2	363830116241401	Airport Well	2,638.8	1.05	01-28-1999	0940	325.34	2,313.5	V	—	EMP
					02-25-1999	0938	325.01	2,313.8	V	—	EMP
					03-24-1999	1322	325.09	2,313.7	V	—	EMP
					04-14-1999	1150	325.26	2,313.5	V	—	EMP
					05-19-1999	1210	325.07	2,313.7	V	—	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-2	363830116241401	Airport Well	2,638.8	1.15	06-16-1999	1205	325.57	2,313.2	V	—	EMP
					07-27-1999	1629	325.16	2,313.6	S	—	EMP
					08-09-1999	1038	325.24	2,313.6	S	—	EMP
					09-23-1999	1358	325.17	2,313.6	S	—	EMP
					10-07-1999	0753	325.53	2,313.3	S	—	EMP
					10-16-1999	1332	325.52	2,313.3	S	—	EMP
					11-04-1999	1219	325.25	2,313.6	S	—	EMP
					12-14-1999	0919	325.61	2,313.2	S	—	EMP
AD-2a	363835116234001	NDOT Well	2,656.8	0.4	01-28-1999	0959	342.47	2,314.3	V	—	EMP
					02-25-1999	1005	341.93	2,314.9	S	—	EMP
					03-25-1999	0925	342.01	2,314.8	S	—	EMP
					04-12-1999	1345	343.72	2,313.1	S	—	EMP
					05-19-1999	1140	344.74	2,312.1	S	—	EMP
					06-16-1999	0710	343.92	2,312.9	S	—	EMP
					07-28-1999	0814	343.06	2,313.7	S	—	EMP
					08-26-1999	1448	342.67	2,314.1	S	—	EMP
					09-23-1999	1429	342.99	2,313.8	S	—	EMP
					10-07-1999	1210	343.39	2,313.4	S	—	EMP
					10-18-1999	1819	342.34	2,314.5	S	—	EMP
					11-04-1999	1624	342.22	2,314.6	S	—	EMP
					12-13-1999	1146	341.92	2,314.9	S	—	EMP
AD-3a	363521116352501	Davidson Well	2,395.3	1.00	01-27-1999	1155	132.19	2,263.1	S	—	EMP
					02-23-1999	1030	132.10	2,263.2	S	—	EMP
					03-16-1999	1320	132.03	2,263.3	S	—	EMP
					04-12-1999	1447	132.08	2,263.2	S	—	EMP
					05-19-1999	1315	132.28	2,263.0	S	—	EMP
					06-15-1999	1125	132.42	2,262.9	S	—	EMP
					07-27-1999	1525	132.64	2,262.7	S	—	EMP
					08-06-1999	1430	132.73	2,262.6	S	—	EMP
					09-23-1999	1308	132.88	2,262.4	S	—	EMP
					10-08-1999	0715	133.00	2,262.3	S	—	EMP
					10-16-1999	1417	132.99	2,262.3	S	—	EMP
					11-15-1999	0624	133.07	2,262.2	S	—	EMP
					12-13-1999	1526	132.92	2,262.4	S	—	EMP
AD-4a	363428116234701	Cooks East Well	2,477.8	1.0	01-27-1999	1242	119.79	2,358.0	S	—	EMP
					02-23-1999	1149	119.70	2,358.1	S	—	EMP
					03-16-1999	1250	119.62	2,358.2	S	—	EMP
					04-12-1999	1420	119.68	2,358.1	S	—	EMP
					05-19-1999	1248	119.57	2,358.2	S	—	EMP

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement: Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-4a	363428116234701	Cooks East Well	2,477.8	1.0	06-15-1999	1210	119.63	2,358.2	S	—	EMP
					07-27-1999	1557	119.58	2,358.2	S	—	EMP
					08-06-1999	1500	119.26	2,358.5	S	—	EMP
					09-23-1999	1336	119.40	2,358.4	S	—	EMP
					10-08-1999	0648	119.55	2,358.2	S	—	EMP
					10-16-1999	1310	116.56	2,361.2	S	—	EMP
					11-04-1999	1159	116.70	2,361.1	S	—	EMP
					12-14-1999	0944	117.38	2,360.4	S	—	EMP
AD-5	363310116294001	USBLM Well	2,376.4	0.0	01-20-1999	1313	128.83	2,247.6	S	—	EMP
					02-23-1999	1110	127.20	2,249.2	S	—	EMP
					03-16-1999	1350	127.61	2,248.8	S	—	EMP
					04-12-1999	1521	127.66	2,248.7	S	—	EMP
					05-19-1999	1340	127.74	2,248.7	S	—	EMP
					06-15-1999	1100	127.90	2,248.5	S	—	EMP
					07-27-1999	1502	128.10	2,248.3	S	—	EMP
					08-06-1999	1404	128.16	2,248.2	S	—	EMP
					09-23-1999	1244	128.48	2,247.9	S	—	EMP
					10-08-1999	0737	128.58	2,247.8	S	—	EMP
					10-16-1999	1358	128.64	2,247.8	S	—	EMP
					11-15-1999	0655	128.74	2,247.7	S	—	EMP
					12-13-1999	1549	128.72	2,247.7	S	—	EMP
AD-6	363213116133800	Tracer Well 3	2,402.3	0.4	01-28-1999	1031	41.80	2,360.5	S	—	EMP
					02-03-1999	1132	41.62	2,360.7	S	—	EMP
					03-03-1999	1031	41.52	2,360.8	S	—	EMP
					04-06-1999	1330	41.65	2,360.6	S	—	EMP
					05-03-1999	0846	41.50	2,360.8	S	—	EMP
					06-01-1999	0930	41.58	2,360.7	S	—	EMP
					07-07-1999	0745	41.65	2,360.6	S	—	EMP
					08-03-1999	0746	41.66	2,360.6	S	—	EMP
					09-01-1999	0816	41.55	2,360.8	S	—	EMP
					10-05-1999	0800	41.60	2,360.7	S	—	EMP
					11-01-1999	0846	41.77	2,360.5	S	—	EMP
					12-14-1999	1115	41.82	2,360.5	S	—	EMP
AD-7a	363009116302702	BlackmanWell	2,305.0	0.78	01-27-1999	1120	69.60	2,235.4	S	—	EMP
					02-23-1999	1230	69.55	2,235.4	S	—	EMP
					03-11-1999	—	69.89	2,235.1	T	—	NDWR
					03-16-1999	1415	70.54	2,234.5	S	—	EMP
					04-12-1999	1546	71.36	2,233.6	S	—	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-7a	363009116302702	BlackmanWell	2,305.0	0.78	05-19-1999	1355	73.76	2,231.2	S	—	EMP
					06-15-1999	1040	74.94	2,230.1	S	—	EMP
					07-27-1999	1445	76.46	2,228.5	S	—	EMP
					08-06-1999	1340	77.02	2,228.0	S	—	EMP
					09-23-1999	1223	77.19	2,227.8	S	—	EMP
					10-08-1999	0753	77.19	2,227.8	S	—	EMP
					10-09-1999	—	77.08	2,227.9	S	—	NDWR
					10-19-1999	1319	77.00	2,228.0	S	—	EMP
					11-15-1999	0713	75.94	2,229.1	S	—	EMP
					12-13-1999	1610	74.72	2,230.3	S	—	EMP
AD-8	362929116085701	Cherry Patch Well	2,394.3	0.6	01-28-1999	0715	35.15	2,359.2	S	—	EMP
					02-25-1999	0705	35.19	2,359.1	S	—	EMP
					03-25-1999	0712	35.00	2,359.3	S	—	EMP
					04-27-1999	0932	35.00	2,359.3	S	—	EMP
					05-20-1999	0820	42.44	2,351.9	S	P	EMP
					06-17-1999	0720	49.13	2,345.2	S	P	EMP
					07-28-1999	1215	51.49	2,342.8	S	P	EMP
					08-26-1999	1647	34.44	2,359.9	S	—	EMP
					09-29-1999	0857	34.95	2,359.4	S	—	EMP
					10-07-1999	1425	35.03	2,359.3	S	—	EMP
					10-19-1999	0848	35.37	2,358.9	S	—	EMP
					11-04-1999	0841	34.45	2,359.8	S	—	EMP
					12-14-1999	1038	34.93	2,359.4	S	—	EMP
AD-9	362848116264201	Gilgans North Well	2,264.8	-0.10	01-27-1999	1050	80.06	2,184.7	S	—	EMP
					02-23-1999	1250	80.81	2,184.0	S	—	EMP
					03-11-1999	—	81.87	2,182.9	T	—	NDWR
					03-16-1999	1438	83.42	2,181.4	S	—	EMP
					04-12-1999	1612	80.94	2,183.9	S	—	EMP
					05-19-1999	1415	86.98	2,177.8	S	—	EMP
					06-15-1999	1020	87.92	2,176.9	S	—	EMP
					07-27-1999	1429	89.77	2,175.0	S	—	EMP
					08-06-1999	1311	90.17	2,174.6	S	—	EMP
					09-23-1999	1202	84.28	2,180.5	S	—	EMP
					10-08-1999	0811	86.85	2,178.0	S	—	EMP
					10-09-1999	—	88.82	2,176.0	S	—	NDWR
					10-19-1999	1301	86.99	2,177.8	S	—	EMP
					11-15-1999	0734	83.82	2,181.0	S	—	EMP
					12-13-1999	1641	82.99	2,181.8	S	—	EMP

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-10	362525116274301	NA-9 Well	2,190.9	1.3	01-27-1999	0635	12.13	2,178.8	S	—	EMP
					02-22-1999	1450	12.18	2,178.7	S	—	EMP
					03-16-1999	0922	12.13	2,178.8	S	—	EMP
					04-13-1999	1247	12.19	2,178.7	S	—	EMP
					05-18-1999	1333	12.16	2,178.7	S	—	EMP
					06-14-1999	1555	12.20	2,178.7	S	—	EMP
					07-27-1999	1403	12.30	2,178.6	S	—	EMP
					08-06-1999	1243	12.18	2,178.7	S	—	EMP
					09-17-1999	1306	12.07	2,178.8	S	—	EMP
					10-08-1999	0831	12.12	2,178.8	S	—	EMP
					10-19-1999	0926	12.33	2,178.6	S	—	EMP
					11-15-1999	0756	11.40	2,179.5	S	—	EMP
					12-14-1999	1004	11.39	2,179.5	S	—	EMP
AD-11	361954116181201	GS-03 Well	2,351.3	2.0	01-26-1999	0915	218.19	2,133.1	S	—	EMP
					02-16-1999	1352	218.15	2,133.2	S	—	EMP
					03-24-1999	0738	217.69	2,133.6	S	—	EMP
					04-13-1999	0714	217.43	2,133.9	S	—	EMP
					05-17-1999	1530	216.84	2,134.5	S	—	EMP
					06-14-1999	1202	216.31	2,135.0	S	—	EMP
					07-27-1999	1219	215.64	2,135.7	S	—	EMP
					08-06-1999	1007	215.39	2,135.9	S	—	EMP
					09-29-1999	1137	214.93	2,136.4	S	—	EMP
					10-08-1999	1143	214.89	2,136.4	S	—	EMP
					10-18-1999	1720	214.77	2,136.5	S	—	EMP
					11-03-1999	1152	214.55	2,136.8	S	—	EMP
					12-10-1999	0911	213.77	2,137.5	S	—	EMP
AD-12	362014116133901	GS-01 Well	2,430.3	2.0	01-26-1999	0840	80.90	2,349.4	S	—	EMP
					02-16-1999	1436	80.88	2,349.4	S	—	EMP
					03-24-1999	0650	80.88	2,349.4	S	—	EMP
					04-13-1999	0625	80.86	2,349.4	S	—	EMP
					05-19-1999	1508	80.87	2,349.4	S	—	EMP
					06-14-1999	1110	80.88	2,349.4	S	—	EMP
					07-27-1999	1139	80.89	2,349.4	S	—	EMP
					08-06-1999	1049	80.94	2,349.4	S	—	EMP
					09-17-1999	1021	80.98	2,349.3	S	—	EMP
					10-07-1999	1808	80.97	2,349.3	S	—	EMP
					10-16-1999	1105	81.04	2,349.3	S	—	EMP
					11-04-1999	0543	80.98	2,349.3	S	—	EMP
					12-10-1999	0832	80.97	2,349.3	S	—	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AD-13	361724116324201	S-1 Well	2,703.2	2.0	01-20-1999	1134	373.63	2,329.6	S	—	EMP
					02-18-1999	1440	373.57	2,329.6	S	—	EMP
					03-16-1999	1127	373.65	2,329.6	S	—	EMP
					04-13-1999	0815	373.69	2,329.5	S	—	EMP
					05-18-1999	0850	373.15	2,330.0	S	—	EMP
					06-14-1999	1320	373.47	2,329.7	S	—	EMP
					07-27-1999	0555	373.62	2,329.6	S	—	EMP
					08-06-1999	0841	373.29	2,329.9	S	—	EMP
					09-23-1999	0933	373.45	2,329.8	S	—	EMP
					10-08-1999	0918	373.44	2,329.8	S	—	EMP
					10-19-1999	1010	372.31	2,330.9	S	—	EMP
					11-03-1999	1735	372.40	2,330.8	S	—	EMP
					12-13-1999	0900	372.48	2,330.7	S	—	EMP
AD-14	361817116244701	Death Valley Junction Well	2,041.8	0.7	01-26-1999	1005	2.99	2,038.8	S	—	EMP
					02-23-1999	1503	2.81	2,039.0	S	—	EMP
					03-16-1999	1232	2.96	2,038.8	S	—	EMP
					04-13-1999	0747	2.56	2,039.2	S	—	EMP
					05-17-1999	1455	2.53	2,039.3	S	—	EMP
					06-14-1999	1252	2.43	2,039.4	S	—	EMP
					06-29-1999	—	2.95	2,038.8	N	—	USGS-NV
					07-27-1999	0751	2.61	2,039.2	S	—	EMP
					08-06-1999	0925	3.02	2,038.8	S	—	EMP
					09-29-1999	1215	3.17	2,038.6	S	—	EMP
					10-08-1999	1117	3.24	2,038.6	S	—	EMP
					10-19-1999	1237	3.05	2,038.8	S	—	EMP
					11-15-1999	0907	3.33	2,038.5	S	—	EMP
					12-13-1999	0836	2.90	2,038.9	S	—	EMP
AM-1	362858116195301	Rogers Spring Well	2,265.9	0.1	01-19-1999	1445	2.58	2,263.3	T	—	USFWS
					01-27-1999	0735	2.49	2,263.4	S	—	EMP
					02-19-1999	0940	2.45	2,263.4	S	—	EMP
					02-24-1999	1200	2.48	2,263.4	T	—	USFWS
					03-16-1999	0740	2.33	2,263.6	S	—	EMP
					03-24-1999	1420	2.44	2,263.5	T	—	USFWS
				0.14	04-13-1999	1042	3.34	2,262.6	S	—	EMP
					04-26-1999	0820	2.37	2,263.5	T	—	USFWS
					05-18-1999	0940	2.46	2,263.4	S	—	EMP
					05-19-1999	0915	2.50	2,263.4	T	—	USFWS

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-1	362858116195301	Rogers Spring Well	2,265.9		06-15-1999	0818	2.84	2,263.1	S	—	EMP
					06-21-1999	1010	3.05	2,262.8	T	—	USFWS
					07-13-1999	1455	3.41	2,262.5	T	—	USFWS
					07-27-1999	0950	3.55	2,262.4	S	—	EMP
					08-06-1999	1151	3.63	2,262.3	S	—	EMP
					08-19-1999	1050	3.83	2,262.1	T	—	USFWS
					09-29-1999	1052	3.58	2,262.3	S	—	EMP
					09-29-1999	1130	3.33	2,262.6	T	—	USFWS
					10-07-1999	1455	3.50	2,262.4	S	—	EMP
					10-16-1999	1240	3.46	2,262.4	S	—	EMP
					10-26-1999	1035	3.50	2,262.4	T	—	USFWS
					11-04-1999	1132	3.15	2,262.8	S	—	EMP
					11-16-1999	1120	3.15	2,262.8	T	—	USFWS
					12-10-1999	1210	2.80	2,263.1	S	—	EMP
					12-20-1999	1445	2.76	2,263.1	T	—	USFWS
					10-26-1999	1035	3.50	2,262.4	T	—	USFWS
					11-04-1999	1132	3.15	2,262.8	S	—	EMP
					11-16-1999	1120	3.15	2,262.8	T	—	USFWS
					12-10-1999	1210	2.80	2,263.1	S	—	EMP
					12-20-1999	1445	2.76	2,263.1	T	—	USFWS
AM-2	362755116190401	Five Springs Well	2,367.4	1.17	01-27-1999	0805	0.24	2,367.2	S	F	EMP
					02-19-1999	0843	0.24	2,367.2	S	F	EMP
					03-24-1999	0841	0.23	2,367.2	S	F	EMP
					04-13-1999	1111	0.23	2,367.2	S	F	EMP
					05-18-1999	1000	0.22	2,367.2	S	F	EMP
					06-15-1999	0715	0.23	2,367.2	S	F	EMP
					07-27-1999	0927	0.24	2,367.2	S	F	EMP
					08-25-1999	1847	0.23	2,367.2	S	F	EMP
					09-29-1999	1022	0.23	2,367.2	S	F	EMP
					10-07-1999	1547	0.23	2,367.2	S	F	EMP
					10-18-1999	1602	0.21	2,367.2	S	F	EMP
					11-04-1999	1109	0.21	2,367.2	S	F	EMP
					12-10-1999	1145	0.22	2,367.2	S	F	EMP
AM-3	362555116205301	Garners Well	2,157.0	1.29	01-27-1999	0905	18.72	2,138.3	S	—	EMP
					02-19-1999	1015	18.56	2,138.4	S	—	EMP
					03-16-1999	0708	18.39	2,138.6	S	—	EMP
					04-13-1999	1217	18.29	2,138.7	S	—	EMP
					05-18-1999	1115	18.24	2,138.8	S	—	EMP

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-3	362555116205301	Garners Well	2,157.0	1.29	06-15-1999	0835	18.44	2,138.6	S	—	EMP
					07-27-1999	1324	19.25	2,137.8	S	—	EMP
					08-06-1999	1218	19.41	2,137.6	S	—	EMP
					09-17-1999	1241	20.11	2,136.9	S	—	EMP
					10-07-1999	1618	20.28	2,136.7	S	—	EMP
					10-16-1999	1226	20.20	2,136.8	S	—	EMP
					11-04-1999	0610	20.11	2,136.9	S	—	EMP
					12-10-1999	1232	19.94	2,137.1	S	—	EMP
AM-4	362532116172700	Devils Hole	2,359.9	—	01-05-1999	0713	2.01	2,357.9	S	—	NPS
					02-04-1999	0733	1.87	2,358.0	S	—	NPS
					03-02-1999	0742	1.95	2,358.0	S	—	NPS
					04-06-1999	0553	1.93	2,358.0	S	—	NPS
					04-11-1999	0915	1.98	2,357.9	S	—	NPS
					05-04-1999	0548	1.93	2,358.0	S	—	NPS
					05-19-1999	0538	1.88	2,358.0	S	—	NPS
					06-01-1999	0535	1.89	2,358.0	S	—	NPS
					06-16-1999	0543	1.88	2,358.0	S	—	NPS
					07-06-1999	0730	2.02	2,357.9	S	—	NPS
					08-03-1999	0618	2.01	2,357.9	S	—	NPS
					08-18-1999	1112	1.89	2,358.0	S	—	EMP
					09-01-1999	0559	1.90	2,358.0	S	—	NPS
					10-01-1999	0732	1.89	2,358.0	S	—	NPS
					10-19-1999	0631	2.22	2,357.7	S	—	NPS
					11-02-1999	0723	2.22	2,357.7	S	—	NPS
					12-01-1999	0714	2.11	2,357.8	S	—	NPS
AM-5	362529116171100	Devils Hole Well	2,404.1	0.9	01-19-1999	1610	48.10	2,356.0	T	—	USFWS
					01-27-1999	0930	48.17	2,355.9	S	—	EMP
					02-18-1999	1025	48.10	2,356.0	S	—	EMP
					02-24-1999	1000	48.13	2,356.0	T	—	USFWS
					03-16-1999	0637	48.05	2,356.0	S	—	EMP
					03-24-1999	1115	48.10	2,356.0	T	—	USFWS
					04-13-1999	1325	48.14	2,356.0	S	—	EMP
					04-26-1999	1015	48.14	2,356.0	T	—	USFWS
					05-18-1999	1130	48.09	2,356.0	S	—	EMP
					05-19-1999	1100	48.08	2,356.0	T	—	USFWS

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-5	362529116171100	Devils Hole Well	2,404.1	0.9	06-15-1999	0853	48.06	2,356.0	S	—	EMP
					06-21-1999	1110	48.05	2,356.0	T	—	USFWS
					07-13-1999	1535	48.12	2,356.0	T	—	USFWS
					07-27-1999	1305	48.15	2,356.0	S	—	EMP
					08-06-1999	1122	48.04	2,356.1	S	—	EMP
					08-19-1999	1155	48.01	2,356.1	T	—	USFWS
					09-17-1999	1227	47.96	2,356.1	S	—	EMP
					09-29-1999	0915	48.04	2,356.1	T	—	USFWS
					10-07-1999	1634	47.95	2,356.2	S	—	EMP
					10-16-1999	1211	48.01	2,356.1	S	—	EMP
					10-26-1999	0920	48.01	2,356.1	T	—	USFWS
					11-04-1999	0621	47.98	2,356.1	S	—	EMP
					11-16-1999	1025	47.97	2,356.1	T	—	USFWS
					12-10-1999	1038	47.93	2,356.2	S	—	EMP
					12-20-1999	1545	47.97	2,356.1	T	—	USFWS
AM-6	362432116165701	Point of Rocks North Well	2,318.8	0.0	01-19-1999	1655	21.41	2,297.4	T	—	USFWS
					01-27-1999	0948	21.45	2,297.4	S	—	EMP
					02-19-1999	0705	21.47	2,297.3	S	—	EMP
					02-24-1999	1033	21.45	2,297.4	T	—	USFWS
					03-16-1999	0816	21.53	2,297.3	S	—	EMP
					03-24-1999	1043	21.53	2,297.3	T	—	USFWS
					04-13-1999	1352	21.54	2,297.3	S	—	EMP
					04-26-1999	1027	21.50	2,297.3	T	—	USFWS
					05-18-1999	1218	21.56	2,297.2	S	—	EMP
					05-19-1999	1136	21.51	2,297.3	T	—	USFWS
					06-15-1999	0922	21.55	2,297.2	S	—	EMP
					06-21-1999	1147	21.54	2,297.3	T	—	USFWS
					07-13-1999	1600	21.56	2,297.2	T	—	USFWS
					07-27-1999	1030	21.70	2,297.1	S	—	EMP
					08-05-1999	1929	21.64	2,297.2	S	—	EMP
					08-19-1999	1020	21.61	2,297.2	T	—	USFWS
					09-17-1999	1101	21.61	2,297.2	S	—	EMP
					09-29-1999	0900	21.56	2,297.2	T	—	USFWS
					10-07-1999	1706	21.58	2,297.2	S	—	EMP
					10-16-1999	1151	21.73	2,297.1	S	—	EMP
					10-26-1999	0830	21.45	2,297.4	T	—	USFWS
					11-04-1999	0915	21.50	2,297.3	S	—	EMP
					11-16-1999	0950	21.47	2,297.3	T	—	USFWS
					12-10-1999	1003	21.49	2,297.3	S	—	EMP
					12-20-1999	1555	21.45	2,297.4	T	—	USFWS

Table 5. Periodic water-level data at monitoring sites in Yucca Mountain region for calendar year 1999—Continued

Site number (fig. 1)	U.S. Geological Survey site identification	Site name	Land-surface altitude (feet above sea level)	Height of measurement point (feet above land surface)	Water-level measurement						
					Date	Time	Depth to water (feet below land surface)	Altitude of water surface (feet above sea level)	Method	Site status	Data source
AM-7	362417116163600	Point of Rocks South Well	2,333.5	0.8	01-19-1999	1645	7.44	2,326.1	T	—	USFWS
					01-27-1999	1020	7.48	2,326.0	S	—	EMP
					02-19-1999	0745	7.47	2,326.0	S	—	EMP
					02-24-1999	1045	7.45	2,326.0	T	—	USFWS
					03-16-1999	0845	7.46	2,326.0	S	—	EMP
					03-24-1999	1055	7.49	2,326.0	T	—	USFWS
					04-13-1999	1426	7.52	2,326.0	S	—	EMP
					04-26-1999	1040	7.51	2,326.0	T	—	USFWS
					05-18-1999	1252	7.46	2,326.0	S	—	EMP
					05-19-1999	1145	7.46	2,326.0	T	—	USFWS
					06-15-1999	0950	7.49	2,326.0	S	—	EMP
					06-21-1999	1200	7.49	2,326.0	T	—	USFWS
					07-13-1999	1550	7.51	2,326.0	T	—	USFWS
					07-27-1999	1100	7.53	2,326.0	S	—	EMP
					08-05-1999	1951	7.41	2,326.1	S	—	EMP
					08-19-1999	1030	7.44	2,326.1	T	—	USFWS
					09-17-1999	1131	7.40	2,326.1	S	—	EMP
					09-29-1999	0850	7.39	2,326.1	T	—	USFWS
					10-07-1999	1732	7.33	2,326.2	S	—	EMP
					10-16-1999	1133	6.62	2,326.9	S	—	EMP
					10-26-1999	0850	6.69	2,326.8	T	—	USFWS
					11-04-1999	0930	6.76	2,326.7	S	—	EMP
					11-16-1999	1010	6.86	2,326.6	T	—	USFWS
					12-10-1999	1020	7.05	2,326.4	S	—	EMP
					12-20-1999	1605	7.11	2,326.4	T	—	USFWS
DV-3	362230116392901	Travertine Point 1 Well	2,728.4	2.0	01-27-1999	1420	601.11	2,127.3	V	—	EMP
					02-23-1999	1404	601.24	2,127.2	V	—	EMP
					03-16-1999	1029	601.16	2,127.2	V	—	EMP
					04-13-1999	0915	601.13	2,127.3	V	—	EMP
					05-18-1999	0800	601.19	2,127.2	V	—	EMP
					06-14-1999	1443	601.09	2,127.3	V	—	EMP
					07-27-1999	0702	601.25	2,127.2	V	—	EMP
					08-06-1999	0732	601.23	2,127.2	V	—	EMP
					09-23-1999	1049	601.32	2,127.1	V	—	EMP
					10-08-1999	1019	601.41	2,127.0	V	—	EMP
					10-19-1999	1147	601.42	2,127.0	V	—	EMP
					11-03-1999	1309	601.39	2,127.0	V	—	EMP
					12-13-1999	1020	601.36	2,127.0	V	—	EMP

Table 6. Daily average water levels in well JF-3 for calendar year 1999

[Symbol: —, data not available]

Day	Water level, in feet below land surface											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	710.26	710.39	710.12	710.05	710.29	710.03	709.98	710.09	709.95	709.87	710.06	709.91
2	710.27	710.36	710.08	710.13	710.02	709.90	709.91	710.23	710.01	709.89	710.03	709.92
3	710.37	710.09	709.85	710.00	709.91	710.04	709.98	710.18	710.10	710.10	709.98	710.13
4	710.40	709.92	709.94	710.13	710.17	710.08	710.16	710.07	710.20	710.13	709.93	710.22
5	710.27	710.20	710.13	710.21	710.38	710.22	710.29	709.97	710.20	709.97	710.06	710.08
6	710.12	710.29	709.99	710.21	710.31	710.14	710.23	710.02	710.13	709.87	710.10	709.94
7	709.96	710.17	709.97	710.30	710.09	710.05	710.21	710.15	710.14	710.18	709.93	709.74
8	710.26	710.11	710.19	710.32	709.97	710.03	710.29	710.15	710.14	710.20	709.93	710.08
9	710.34	709.97	710.14	710.34	710.05	710.06	710.32	710.04	710.08	710.12	710.05	709.98
10	710.21	710.38	710.19	710.32	710.17	710.11	710.28	710.00	710.05	710.09	710.04	709.86
11	709.98	710.70	710.11	710.13	710.20	710.17	710.17	710.16	710.11	710.09	710.14	710.13
12	710.00	710.47	710.37	710.22	710.04	710.23	710.16	710.22	710.19	710.14	710.15	710.10
13	710.25	710.21	710.30	710.31	709.94	710.20	710.07	710.12	710.16	710.10	710.10	709.91
14	710.35	709.97	710.09	710.35	710.08	710.12	710.02	710.00	710.04	709.92	710.05	710.21
15	710.09	710.11	709.94	710.32	710.17	710.04	710.03	710.14	710.02	709.86	709.98	710.21
16	709.95	710.12	710.10	710.27	710.29	710.05	710.08	710.28	710.07	710.27	709.84	710.06
17	710.12	710.09	710.21	710.22	710.29	710.12	710.12	710.23	710.13	710.35	709.80	710.00
18	710.14	710.02	710.31	710.19	710.09	710.13	710.18	710.05	710.09	710.12	710.09	709.87
19	710.09	710.17	710.27	710.09	710.03	710.07	710.18	710.08	710.03	710.16	710.12	710.01
20	709.97	710.31	710.15	709.88	710.06	709.99	710.14	710.14	710.19	710.17	709.97	710.05
21	710.15	710.15	710.23	709.75	710.06	709.93	710.16	710.09	710.20	710.11	709.92	709.98
22	710.33	710.42	710.14	709.83	710.08	710.08	710.22	710.05	710.12	710.02	710.20	710.23
23	710.04	710.27	710.05	710.04	710.23	710.14	710.17	710.07	710.04	710.00	710.23	710.28
24	709.99	710.08	710.14	710.20	710.25	710.07	710.06	710.08	710.07	710.04	710.30	710.20
25	709.94	709.91	710.09	710.25	710.16	710.01	710.09	710.07	710.05	710.09	710.12	710.00
26	710.15	710.13	710.02	710.16	710.17	710.01	710.11	710.03	709.96	709.98	709.86	710.02
27	710.44	710.26	710.16	710.01	710.16	710.13	710.10	710.06	709.98	709.97	709.92	710.09
28	710.47	710.23	710.35	709.85	710.02	710.21	710.14	710.10	710.31	709.92	710.16	709.98
29	710.38	—	710.22	710.04	709.94	710.19	710.18	710.07	710.24	710.22	710.18	709.78
30	710.21	—	709.89	710.29	710.09	710.07	710.08	709.99	710.02	710.28	709.96	709.80
31	710.06	—	709.90	—	710.16	—	710.04	710.04	—	710.14	—	709.68
Mean	710.18	710.20	710.12	710.15	710.12	710.09	710.13	710.10	710.10	710.08	710.04	710.01
Maximum	710.47	710.70	710.37	710.35	710.38	710.23	710.32	710.28	710.31	710.35	710.30	710.28
Minimum	709.94	709.91	709.85	709.75	709.91	709.90	709.91	709.97	709.95	709.86	709.80	709.68

(1999 annual summary: mean = 710.11; maximum = 710.70; minimum = 709.68)

Table 7. Daily average water levels in well AD-6 for calendar year 1999

[Symbol: —, data not available]

Day	Water level, in feet below land surface											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1	41.74	41.75	41.59	41.57	41.64	41.55	41.48	41.58	41.53	41.51	41.71	41.68
2	41.71	41.72	41.58	41.59	41.52	41.51	41.46	41.64	41.56	41.53	41.71	41.69
3	41.76	41.60	41.48	41.53	41.50	41.58	41.50	41.61	41.58	41.62	41.69	41.79
4	41.78	41.54	41.55	41.60	41.61	41.59	41.57	41.57	41.61	41.61	41.67	41.82
5	41.73	41.68	41.62	41.61	41.68	41.63	41.61	41.53	41.60	41.54	41.72	41.76
6	41.67	41.69	41.54	41.60	41.63	41.57	41.58	41.57	41.57	41.51	41.73	41.70
7	41.61	41.63	41.54	41.65	41.53	41.55	41.58	41.62	41.58	41.65	41.66	41.62
8	41.75	41.61	41.64	41.66	41.50	41.54	41.63	41.61	41.58	41.63	41.67	41.79
9	41.76	41.55	41.60	41.68	41.55	41.55	41.64	41.56	41.56	41.60	41.73	41.71
10	41.70	41.75	41.61	41.66	41.60	41.57	41.62	41.55	41.55	41.59	41.71	41.66
11	41.61	41.86	41.58	41.58	41.60	41.59	41.59	41.62	41.58	41.59	41.75	41.79
12	41.63	41.74	41.69	41.63	41.52	41.61	41.59	41.63	41.61	41.61	41.75	41.76
13	41.73	41.65	41.64	41.65	41.49	41.59	41.56	41.58	41.59	41.59	41.73	41.68
14	41.75	41.56	41.55	41.66	41.56	41.56	41.55	41.54	41.54	41.52	41.71	41.82
15	41.64	41.64	41.50	41.65	41.60	41.53	41.55	41.61	41.55	41.51	41.68	41.82
16	41.59	41.62	41.59	41.64	41.64	41.54	41.56	41.66	41.57	41.78	41.63	41.75
17	41.67	41.61	41.62	41.63	41.63	41.57	41.58	41.62	41.59	41.81	41.63	41.73
18	41.66	41.57	41.65	41.62	41.54	41.57	41.60	41.55	41.58	41.71	41.76	41.67
19	41.63	41.64	41.62	41.57	41.54	41.54	41.60	41.57	41.55	41.74	41.75	41.73
20	41.59	41.69	41.58	41.49	41.55	41.51	41.58	41.60	41.63	41.74	41.68	41.74
21	41.67	41.62	41.63	41.45	41.54	41.48	41.60	41.57	41.62	41.72	41.67	41.71
22	41.74	41.75	41.59	41.50	41.55	41.55	41.62	41.56	41.59	41.69	41.80	41.82
23	41.61	41.67	41.56	41.59	41.62	41.56	41.60	41.57	41.57	41.69	41.80	41.82
24	41.60	41.59	41.59	41.64	41.62	41.53	41.55	41.57	41.58	41.70	41.82	41.79
25	41.58	41.53	41.56	41.63	41.58	41.51	41.57	41.57	41.57	41.72	41.75	41.72
26	41.67	41.64	41.53	41.58	41.59	41.52	41.57	41.55	41.53	41.67	41.65	41.75
27	41.78	41.67	41.60	41.52	41.59	41.56	41.57	41.57	41.55	41.67	41.69	41.78
28	41.77	41.64	41.66	41.47	41.53	41.58	41.59	41.58	41.68	41.65	41.79	41.73
29	41.73	—	41.60	41.58	41.51	41.56	41.61	41.57	41.65	41.80	41.78	41.66
30	41.66	—	41.47	41.66	41.58	41.51	41.56	41.54	41.56	41.80	41.68	41.67
31	41.61	—	41.51	—	41.60	—	41.55	41.57	—	41.74	—	41.61
Mean	41.68	41.65	41.58	41.60	41.57	41.55	41.57	41.58	41.58	41.65	41.72	41.73
Maximum	41.78	41.86	41.69	41.68	41.68	41.63	41.64	41.66	41.68	41.81	41.82	41.82
Minimum	41.58	41.53	41.47	41.45	41.49	41.48	41.46	41.53	41.53	41.51	41.63	41.61

(1999 annual summary: mean = 41.62; maximum = 41.86; minimum = 41.45)

Table 8. Ground-water-discharge data at monitoring sites in Yucca Mountain region for calendar year 1999

Site number: Sites are grouped by hydrographic area and, within each area, are listed in general north-to-south, then west-to-east order. See section "Site Number" for further discussion.

U.S. Geological Survey site identification: Unique identification number for site as stored in files and data bases of U.S. Geological Survey (USGS).

Discharge: Reported to two significant figures.

Method: Method used to measure discharge. C, current meter; F, flume; V, volumetric; Z, discharge represents monthly mean discharge on basis of continually recorded stage (see section "Ground-Water Discharge Data" for further discussion).

Data source: EMP, Environmental-Monitoring Program (USGS); NPS, National Park Service; USFWS, U.S. Fish & Wildlife Service.

Site number (fig.1)	U.S. Geological Survey site identification	Site name	Discharge measurement				
			Date	Time	Discharge (gallons per minute)	Method	Data source
AM-1a	362924116203001	Fairbanks Spring	01-19-1999	1500	1,800	F	USFWS
			02-22-1999	1338	1,600	C	EMP
			02-23-1999	1225	1,800	F	USFWS
			03-24-1999	1440	1,800	F	USFWS
			04-06-1999	0925	1,800	F	USFWS
			05-19-1999	0955	1,800	F	USFWS
			05-25-1999	1042	1,600	C	EMP
			06-21-1999	1030	1,800	F	USFWS
			07-12-1999	1515	1,800	F	USFWS
			07-30-1999	0900	1,800	F	USFWS
			08-18-1999	1004	1,600	C	EMP
			08-23-1999	1105	1,800	F	USFWS
			09-24-1999	1230	1,800	F	USFWS
			10-13-1999	0925	1,800	F	USFWS
			11-15-1999	1007	1,700	C	EMP
			11-24-1999	1155	1,800	F	USFWS
			12-21-1999	1500	1,800	F	USFWS
AM-2	362755116190401	Five Springs Well	01-27-1999	0820	39	V	EMP
			02-19-1999	0858	40	V	EMP
			03-24-1999	0902	40	V	EMP
			04-13-1999	1124	38	V	EMP
			05-18-1999	1014	39	V	EMP
			06-15-1999	0729	42	V	EMP
			07-27-1999	0903	41	V	EMP
			08-25-1999	1818	44	V	EMP
			09-29-1999	1005	42	V	EMP
			10-07-1999	1530	43	V	EMP
			10-18-1999	1617	59	V	EMP
			11-04-1999	1059	58	V	EMP
			12-10-1999	1132	55	V	EMP
AM-5a	362502116192301	Crystal Pool	01-20-1999	0900	3,000	C	USFWS
			02-22-1999	1146	3,000	C	EMP
			02-25-1999	1330	2,800	C	USFWS
			03-24-1999	1510	2,900	C	USFWS
			04-06-1999	1400	2,900	C	USFWS

Table 8. Ground-water-discharge data at monitoring sites in Yucca mountain region for calendar year 1999—Continued

Site number (fig.1)	U.S. Geological Survey site identification	Site name	Discharge measurement: Date	Time	Discharge (gallons per minute)	Method	Data source
AM-5a	362502116192301	Crystal Pool	04-26-1999	1630	3,000	C	USFWS
			05-20-1999	0845	2,900	C	USFWS
			05-20-1999	0947	3,000	C	EMP
			06-21-1999	1530	2,600	C	USFWS
			07-30-1999	1210	2,500	C	USFWS
			08-18-1999	0707	2,500	C	EMP
			08-19-1999	1345	2,600	C	USFWS
			09-29-1999	1050	2,800	C	USFWS
			10-19-1999	1550	2,700	C	USFWS
			11-15-1999	1157	2,700	C	EMP
			11-30-1999	1445	2,700	C	USFWS
			12-21-1999	1115	2,700	C	USFWS
AM-8	362230116162001	Big Spring	01-20-1999	1445	1,200	C	USFWS
			02-22-1999	0959	970	C	EMP
			02-25-1999	1435	1,000	C	USFWS
			03-24-1999	0935	1,000	C	USFWS
			04-26-1999	1420	930	C	USFWS
			05-24-1999	1040	1,100	C	USFWS
			05-25-1999	1154	1,100	C	EMP
			06-22-1999	1130	1,000	C	USFWS
			07-30-1999	1335	1,100	C	USFWS
			08-18-1999	0859	990	C	EMP
			08-19-1999	0835	1,000	C	USFWS
			09-29-1999	1530	1,200	C	USFWS
			10-19-1999	0850	1,200	C	USFWS
			11-16-1999	0716	1,100	C	EMP
			11-24-1999	1445	1,200	C	USFWS
			12-21-1999	0840	930	C	USFWS
DV-1	362728116501101	Texas Spring	01-15-1999		200	Z	NPS
			02-15-1999	—	200	Z	NPS
			02-18-1999	0824	190	C	EMP
			03-15-1999	—	200	Z	NPS
			04-15-1999	—	200	Z	NPS
			05-15-1999	—	200	Z	NPS
			05-25-1999	0804	210	C	EMP
			06-15-1999	—	200	Z	NPS
			07-15-1999	—	200	Z	NPS
			09-30-1999	1258	190	C	EMP
DV-2	362252116425301	Navel Spring	02-18-1999	1140	.90	V	EMP
			05-25-1999	0900	.90	V	EMP
			08-26-1999	1212	1.0	V	EMP
			11-03-1999	1640	1.4	V	EMP

Table 9. Estimated annual ground-water withdrawals from wells in Yucca Mountain region for calendar year 1999

Ground-water subbasin (fig. 1)	Hydrographic area (fig. 1)	Ground-water withdrawal [1]	
		Millions of gallons	Acre-feet
Alkali Flat–Furnace Creek Ranch	Amargosa Desert [2]	4,598	14,110
	Crater Flat[3]	90.2	277
	Jackass Flats [3]	33.3	102
Ash Meadows	Amargosa Desert[2] (excluding Ash Meadows area)	20	60
	Amargosa Desert[2] (Ash Meadows area)	3	8
	Mercury Valley[3]	79.7	245

[1] See section "Ground-Water Withdrawal Data" for discussion of data sources.

[2] Data recompiled from ground-water pumpage inventory for entire Amargosa Desert, listed to nearest acre-foot. Domestic use within each part of the Amargosa Desert is based on location and number of wells drilled for domestic purposes (as stored in files maintained by Nevada Divison of Water Resources). Conversion to millions of gallons (325,851 gallons per acre-foot) is rounded to nearest 1 million gallons.

[3] Data reported or recompiled from flowmeter readings and listed to nearest 0.1 million gallons. Conversions to acre-feet are rounded to nearest acre-foot.

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1999. Excludes water-level altitudes that may reflect short-term conditions at a site

Calendar years: Years for which measurements were used to calculate summary statistics. Italics indicate selected baseline period.

Number: Number of water-level measurements for year(s) specified. For JF-2 (1985-93), JF-2a (1985-97), and JF-3, value represents number of daily average water levels.

Water level: Based on periodic water-level measurements made during site visits for JF-1, JF-2 (after 1993), JF-2a (after 1997), J-13, J-11, and J-12. Based on daily average water levels collected from continual data recorders for JF-2 (1985-93), JF-2a (1985-97), and JF-3.

Minimum: Minimum water-level altitude or minimum daily average water-level altitude for year(s) specified.

Maximum: Maximum water-level altitude or maximum daily average water-level altitude for year(s) specified.

Median: Statistically representative water-level altitude calculated from periodic measurements or daily average water levels for year(s) specified.

Average deviation: Calculated dispersion of measurements about median water-level altitude. Average deviation is equal to sum of absolute differences between measured water levels and median, divided by number of measurements.

Change in median: Differences between median water level for calendar years 1992, 1993, 1994, 1995, 1996, 1997, 1998, and 1999 compared with baseline period. Minus sign indicates that median water-level altitude was lower for the specified year than for the baseline period.

[Abbreviations and symbols: N/A, not applicable (data field is not related to referenced data set)]

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	1985–91	86	2,391.7	2,393.1	2,392.5	0.2	N/A
JF-2	1985–91	1,777	2,389.6	2,393.4	2,392.1	.3	N/A
JF-2a	1985–91	1,876	2,466.7	2,469.5	2,468.6	.4	N/A
J-13	1989–91	32	2,389.7	2,390.7	2,390.0	.2	N/A
J-11	1990–91	25	2,401.9	2,402.9	2,402.2	.1	N/A
J-12	1990–91	22	2,388.1	2,388.5	2,388.3	.1	N/A
JF-3	1992–93	582	2,387.7	2,388.8	2,388.3	.1	N/A
JF-1	1999	12	2,392.3	2,393.0	2,392.7	.2	0.2
JF-2	1999	13	2,392.0	2,392.7	2,392.5	.2	.4
JF-2a	1999	13	2,469.8	2,470.4	2,470.2	.2	1.6
J-13	1999	13	2,389.6	2,390.2	2,390.0	.2	0
J-11	1999	14	2,402.2	2,402.8	2,402.4	.2	0.2
J-12	1999	12	2,388.1	2,388.5	2,388.3	.1	0
JF-3	1999	365	2,387.6	2,388.6	2,388.2	.1	-.1
JF-1	1998	22	2,392.3	2,392.8	2,392.5	.1	0
JF-2	1998	21	2,391.8	2,392.6	2,392.1	.1	0
JF-2a	1998	20	2,469.8	2,470.4	2,470.0	.1	1.4
J-13	1998	20	2,389.4	2,390.2	2,389.8	.1	-.2
J-11	1998	20	2,402.2	2,402.9	2,402.6	.2	.4
J-12	1998	17	2,387.9	2,388.3	2,388.0	.1	-.3
JF-3	1998	316	2,387.6	2,388.6	2,388.0	.1	-.3

Table 10. Minimum, maximum, and median water-level altitudes, and average deviation of measurements, at wells in Jackass Flats for selected baseline periods and for calendar years 1992 through 1999—Continued

Site number (fig. 1)	Calendar year(s)	Number	Water level (feet above sea level)			Average deviation (feet)	Change in median (feet)
			Minimum	Maximum	Median		
JF-1	1997	10	2,392.1	2,392.6	2,392.4	0.1	-0.1
JF-2	1997	11	2,391.8	2,392.4	2,392.0	.1	-.1
JF-2a	1997	267	2,468.8	2,470.0	2,469.5	.1	.9
J-13	1997	11	2,389.5	2,389.9	2,389.6	.1	-.4
J-11	1997	10	2,402.2	2,402.8	2,402.6	.2	.4
J-12	1997	16	2,387.7	2,388.4	2,388.0	.1	-.3
JF-3	1997	345	2,387.4	2,388.8	2,388.0	.1	-.3
JF-1	1996	8	2,392.0	2,392.6	2,392.3	.2	-.2
JF-2	1996	7	2,391.6	2,392.3	2,392.1	.2	0
JF-2a	1996	214	2,468.6	2,469.6	2,469.3	.1	.7
J-13	1996	8	2,389.2	2,389.9	2,389.6	.1	-.4
J-11	1996	8	2,402.2	2,402.6	2,402.4	.1	.2
J-12	1996	18	2,387.5	2,388.5	2,388.0	.1	-.3
JF-3	1996	359	2,387.5	2,388.5	2,388.0	.1	-.3
JF-1	1995	7	2,392.3	2,392.8	2,392.5	.2	0
JF-2	1995	9	2,392.2	2,392.5	2,392.4	.1	.3
JF-2a	1995	357	2,468.7	2,469.3	2,469.1	.1	.5
J-13	1995	11	2,389.6	2,390.4	2,389.8	.1	-.2
J-11	1995	11	2,402.2	2,402.5	2,402.4	.1	.2
J-12	1995	16	2,388.0	2,388.3	2,388.2	.1	-.1
JF-3	1995	347	2,387.7	2,388.4	2,388.1	.1	-.2
JF-1	1994	12	2,392.1	2,392.6	2,392.3	.1	-.2
JF-2	1994	9	2,392.0	2,392.6	2,392.2	.1	.1
JF-2a	1994	356	2,468.4	2,469.4	2,469.0	.1	.4
J-13	1994	23	2,389.4	2,390.0	2,389.7	.1	-.3
J-11	1994	12	2,402.0	2,402.5	2,402.3	.1	.1
J-12	1994	24	2,387.8	2,389.1	2,388.2	.2	-.1
JF-3	1994	284	2,387.6	2,388.6	2,388.1	.1	-.2
JF-1	1993	8	2,391.9	2,392.7	2,392.5	.2	0
JF-2	1993	362	2,391.7	2,392.8	2,392.1	.2	0
JF-2a	1993	365	2,468.4	2,469.2	2,468.8	.1	.2
J-13	1993	16	2,389.7	2,390.7	2,389.9	.1	-.1
J-11	1993	8	2,401.9	2,402.7	2,402.2	.2	0
J-12	1993	19	2,387.9	2,389.0	2,388.3	.1	0
JF-1	1992	12	2,392.3	2,392.6	2,392.4	.1	-.1
JF-2	1992	357	2,391.8	2,392.6	2,392.2	.1	.1
JF-2a	1992	342	2,466.9	2,469.2	2,468.6	.5	0
J-13	1992	21	2,389.6	2,390.4	2,389.9	.1	-.1
J-11	1992	12	2,402.0	2,402.6	2,402.2	.1	0
J-12	1992	17	2,388.2	2,388.6	2,388.3	.1	0